

MACHINE  
GUN NOTES

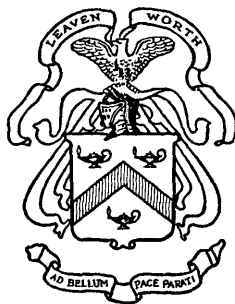
NO. 1

1917

M  
404  
H7  
A.73

THE GENERAL SERVICE SCHOOLS  
**LIBRARY**

THE COMMAND AND GENERAL STAFF COLLEGE  
**LIBRARY**



Call Number M 404-H7-A.73

Accession Number 7321

CGSC Form 154 (Rev) 22 Oct 52  
USA CGSC-P8-0155-19 Jul 57-5M

For Translation See Class

99-G. S. Schs., Fort Leavenworth-8-15-27-25M

26

603  
CLASSIFIED  
AUTH: C-115-50

No. 1

✓ ~~CONFIDENTIAL~~ SM9

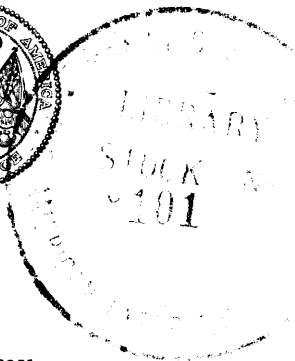
FOR OFFICIAL USE ONLY

# MACHINE GUN NOTES

## No. 1

EDITED AT  
ARMY WAR COLLEGE

MAY, 1917



M  
404-41927

WASHINGTON  
GOVERNMENT PRINTING OFFICE

1917

H7  
C.73

THE COMMAND AND GENERAL STAFF COLLEGE

**LIBRARY**



Call Number M 404-H7-A.73

Accession Number 41927

CGSC Form 154 (Rev) 22 Oct 52  
USA CGSC-P8-0155-19 Jul 57-5M

WAR DEPARTMENT,

WASHINGTON, *May 26, 1917.*

The following reprint of Machine Gun Notes No. 1 is published  
for the information of all concerned.

[2608038, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

TASKER H. BLISS,

*Major General, Acting Chief of Staff.*

OFFICIAL:

H. P. MCCAIN,

*The Adjutant General.*

WAR DEPARTMENT,  
THE ADJUTANT GENERAL'S OFFICE,  
*Washington, June 19, 1917.*

*To all officers of the Army:*

You are advised that this and all subsequent documents of a similar character, which may be furnished to you from this office, are to be regarded as strictly confidential. They are to be kept at all times in your personal possession, and are not to be copied, nor are any parts of their contents to be communicated either directly or indirectly to the press, nor to any persons not in the military or naval service of the United States. In Europe these documents are not to be carried into the front line trenches, nor farther to the front than the usual post of the officers to whom issued.

Strict compliance with this injunction is enjoined upon every officer into whose hands any of these confidential documents may come.

By order of the Secretary of War:

H. P. MCCAIN,  
*The Adjutant General.*

## TABLE OF CONTENTS.

---

### GENERAL.

	Page.
Notes on the employment of Lewis guns in desert warfare....	9
Infantry machine-gun company training.....	33
Notes on the employment of machine guns, 37-mm. guns, and light automatic weapons by Cavalry.....	115
Method of instruction in the Lewis gun.....	149
Methods of laying machine guns in the direction of invisible targets by means of maps, compass, and traversing dial....	180
Some notes on Lewis guns and machine guns.....	183
French notes on machine guns.....	203
Order of the Sixth Bavarian division regarding machine guns.	206

## DETAILED TABLE OF CONTENTS.

	Page.
Notes on the employment of Lewis guns in desert warfare.....	11
EMPLOYMENT OF MACHINE GUNS IN DESERT WARFARE IN EGYPT.	
Control.....	19
Stoppages and action of sand.....	19
Prolonged stoppages.....	20
Transport.....	21
Ammunition supply.....	21
Combined sights.....	21
Indirect fire.....	21
Cooperation between machine-gun companies and Lewis-gun detachments.....	21
Overhead covering fire.....	21
Emplacements.....	22
Horsemanship.....	22
Spare barrels.....	22
Sledges.....	22
Fire.....	23
Command.....	23
HOTCHKISS AND LEWIS GUN COURSES.	
Part I. Instructional.....	24
II. Classification practices 10, 11, and 13 only.....	25
III. Field practices.....	26
Notes on method of conducting the practices:	
Part I. Instructional.....	26
II. Classification practices.....	28
III. Field practices.....	28
IV. Advance field practices.....	30



---

---

**NOTES ON THE EMPLOYMENT**  
**OF**  
**LEWIS GUNS**  
**IN**  
**DESERT WARFARE IN EGYPT**

—  
**ISSUED BY THE BRITISH GENERAL STAFF**  
—

**DECEMBER, 1916**

## NOTES ON THE EMPLOYMENT OF LEWIS GUNS IN DESERT WARFARE.

1. The general experience seems to be that it is never possible to control more than two guns in action, and that it is usually necessary to control each gun separately. This bears out the general experience of Lewis gun officers during the war.

2. Very little trouble seems to have been experienced from stoppages except from the action of sand. This result appears to be due to the realization by commanders of Lewis gun detachments of the necessity of "Care and cleaning," and also to the simplicity and speed with which the guns can be stripped for this purpose. It is necessary to note that parts such as the gas chamber and barrel mouthpiece should be very rarely stripped, as the fine threads by which these parts are connected together easily becoming damaged. On the other hand, the gas cylinder and gas regulator must be frequently stripped, as otherwise it is impossible to clean them properly. The latest pattern of both gas cylinder and gas regulator have much stouter threads than earlier patterns.

As regards prolonged stoppages, the breakage of the cartridge guide spring appears to have been the most common, but to have been very quickly remedied. Plenty of "spares" for the purpose are kept with the gun. Instances are mentioned of guns firing as many as 3,000 rounds without a stoppage. An instance occurred of a bullet carrying away the gas regulator key and at the same time turning the gas regulator. This was not noticed by the gun numbers, and the gun was in consequence out of action for about 15 minutes. This accident would usually have the effect of turning the gun into a hand-operated magazine firer, since the action of the gases is destroyed. This fact should be a useful guide to Lewis gun detachments under similar circumstances. Several separated cases are reported. The fact that no clearing plug has till recently been carried made this stoppage very difficult to deal with, if, as sometimes happened, the separated portion was not extracted from the chamber by the next round. A clearing plug is now being supplied for each gun.

Difficulties from the action of sand were experienced in a greater or less degree by most detachments. The general experience

appears to have been that the amount of trouble met with was proportionate to the amount of care taken. For example, one detachment commander gives his experience as follows: "On August 5 the gun was in action for a short time only, as difficulties were experienced with sand in magazines and in the gun, making it impossible to fire bursts of more than three or four shots. On August 9 we were in action most of the day, as *great care was taken* to keep the gun and magazine free from sand."

The following points were found of assistance by various detachment commanders and should be noted:

(1) Guns when not in use should be kept in the covers which are now being issued. Magazines, too, should be kept in the carriers till the last moment.

(2) Too much oil should not be used to keep the gun clean. Only a slightly oiled rag should be used when the gun is not actually firing.

(3) Suction of sand into the mechanism was prevented by laying a coat or ground sheet under the gun and occasionally by wetting the ground under the forward part.

(4) A magazine which has been dropped in the sand should not be used until it has been unloaded and thoroughly cleaned.

(5) Special precautions must be taken should any wind be blowing.

3. Pack transport appears to have been general and to have been most satisfactory.

4. Combined sights were only used on one or two occasions, owing to the fact that guns were generally used singly. It should be remembered that combined sights are useless for ranging purposes, that they are only needed at long ranges, and that the Lewis gun is primarily a short-range weapon. Still, occasions may arise when combined sights can be employed usefully.

5. Indirect fire was not used and appears not to have been suited to the particular actions described. It is on very rare occasions that Lewis guns can be used for indirect fire because:

(I) Indirect fire can not be directed from a bipod, and

(II) Indirect fire is usually sustained fire for searching woods, approaches, and reverse slopes, and the Lewis gun is unsuited for sustained fire.

6. Cooperation between the machine-gun companies and the Lewis gun detachments was sometimes maintained, but was not sufficiently general. One excellent example is given of the Lewis gun detachment commander not only cooperating with the M. G. section in his vicinity, but also obtaining ranges for the artillery forward

observing officer by means of bursts of fire from his guns.<sup>1</sup> It can not be too strongly impressed on all concerned that cooperation between the Lewis gun detachments and the machine-gun companies both before and during action is essential if the best results are to be obtained.

7. The establishment of one N. C. O. and six men was found adequate for infantry units. In the case of mounted units, an increase of two men, to act as leaders of pack animals and horse holders, appears necessary.

8. The usual methods of "Indication and recognition of targets" appear to have worked satisfactorily.

9. The following points seem worthy of consideration:

(a) A pair of field glasses would be of the greatest assistance to each N. C. O. in charge of a detachment.

(b) Regimental arrangements should be made to insure that an adequate supply of oil is always available with the guns. The provision of ammunition and oil in action is one of the special duties of the battalion Lewis gun officer.

(c) Company commanders should be taught to appreciate the value of their Lewis gun detachments. They can only do this if they have some knowledge of their tactical employment. The fire power of a well-handled Lewis gun is certainly not less than that of 30 rifles.

(d) Numbers 5 and 6 should be trained regimentally in their duties of scouts and range takers.

(e) To aid invisibility and facilitate transport, it has been found useful to cover the radiator casing of the earlier pattern guns with puttees, etc. The more recent pattern guns have, however, been painted service color before issue.

---

<sup>1</sup> The use of Lewis guns for finding ranges for the artillery must be considered very exceptional, e. g., for ranges of not more than 1,500 yards when artillery range finders are not available.

---

---

NOTES ON THE EMPLOYMENT  
OF  
MACHINE GUNS  
IN  
DESERT WARFARE IN EGYPT

---

ISSUED BY THE BRITISH GENERAL STAFF

---

DECEMBER, 1916

## NOTES ON THE EMPLOYMENT OF MACHINE GUNS IN DESERT WARFARE.

1. *Control*.—The general experience has been that the control of more than two guns in action is almost always impossible. This bears out the general experience of machine gunners throughout the war.

2. *Stoppages and action of sand—Vickers*.—With the Vickers guns the only trouble experienced was that when the guns were mounted in the "Low position," sand was sucked up into the mechanism through the ejection opening on the underside of the breech casing. This was remedied in some cases by putting a coat under the gun.

*Maxim*.—A careful consideration of all the reports received from the different units shows that the amount of trouble experienced from stoppages was by no means excessive. In many cases no trouble whatever occurred, and where difficulties did occur they could almost always be traced to two causes:

- (1) The action of sand, and
- (2) The condition of the locks and the lack of spare parts.

As regards the action of sand—as in the case of the Lewis guns—it was obvious that where the trouble from this cause had been foreseen and special precautions had been taken, its ill effects were largely minimized. The following quotation is of interest as bearing out this statement: "No special difficulties were encountered owing to the action of sand in the mechanism, as we were able to keep the guns practically clear of sand by exercising a reasonable amount of care. The guns were examined and cleaned on every possible occasion."

Except when actually in action guns should invariably be kept covered whether on the move or in camp. Bags made from light canvas or any other suitable material can be improvised for this purpose. It should be remembered, however, that guns kept in this way for any length of time need frequent attention; otherwise they very quickly rust. In emplacements, blinds, where provided, should be kept down whenever possible. Special precautions should be taken whenever the wind is blowing.

The trouble caused by sand can be considered under three headings, viz:

(1) Its action in the lock; (2) its action in the feed block; and (3) its action in the belt.

(1) *The lock.*—Locks should not be kept dry but covered with a thin film of oil. A wipe over with an oily rag is all that is necessary. The spare lock should be kept in its wallet until actually required. Any loss of time in changing locks is amply repaid by the fresh lock being fit for use.

(2) *The feed block.*—The above remarks are equally applicable to feed blocks, special attention being paid, as far as oil is concerned, to the action of the slide.

(3) *The belts.*—The greatest care should be taken to keep the boxes and belts free from sand. This precaution is specially necessary just after a belt has been fired. What usually happens is that the used portion of the belt is allowed to fall into the sand on one side of the gun, while the box when empty is thrown aside on the other, getting half filled with sand in the process. The belt is then at once refilled and put back into the sandy box. More sand is worked into the belt in the process of refilling. It is from this source that sand finds its way into the feed blocks causing sluggish feed and trouble with the upper pawls, and hence stoppage in the fourth position.

Too much care can not be taken in the correct filling and overhauling of belts. The latter duty should be carried out by Nos. 3 and 4 during action. It must be remembered that, however accurately a belt may have been filled before moving off, it is quite possible for a few hours on a pack saddle to render it quite incapable of being fired without stoppages.

*Prolonged stoppages.*—These were generally caused by broken cotter pins. This stoppage seems to have occurred to an absolutely inexplicable extent, supposing that the right sized cotter pin was used. It must be remembered that when washers are taken into use the correct size cotter pin must be used with them; this precaution is most essential, otherwise breakages are sure to occur. The length of the connecting rod should be continually tested by the artificers.

In the event of a No. 3 stoppage occurring and of the cover being opened to investigate the cause, the horns of the extractor should always be forced down to remedy this defect. Any attempt to pull them up may lead to an explosion of the cartridge and a resulting accident.

Every effort should be made by company commanders to insure that the sections are as complete as possible in spare parts and particularly in spare locks. In the event of failure to obtain the necessary articles, the company commanders should report the fact to superior authority.

3. *Transport*.—Pack transport was generally used and appears to have been satisfactory. The weight a horse or mule can carry in heavy sand and the best method of packing to avoid any danger of chafing are matters to which company commanders should pay the closest attention.

4. *Ammunition supply*.—Pack animals supplemented when necessary by camels and limbered wagons appear to have been generally used. Careful arrangements seem to have been made by all company commanders to insure the continuity of their supply, and the results appear to have been successful in all cases. Too much emphasis can not be laid on the necessity for these arrangements by all M.G. officers.

5. *Combined sights*.—Combined sights with two guns were used with good results on several occasions. Two instances occur illustrating a right and a wrong method of using this form of fire.

(a) Indirect fire with combined sights was used by one section to search the reverse slope of a hill. This proceeding is very sound, and the officer notes in his report that though observation could not be obtained "the Turks came out."

(b) Another officer reports that he used combined sights "to obtain the range." Combined sights are useless for this purpose.

6. *Indirect fire*.—Indirect fire was seldom employed, but opportunities for the use of this method of fire will occur in future. All sections should be instructed in the "Graticule" and "Spirit level" methods which are very simply and quickly employed in action.

7. *Cooperation between M.G. companies and Lewis gun detachments*.—Cooperation appears to have been attained in several cases, but is not yet sufficiently general. M.G. company and section officers should give the most careful study to this question both in attack and defense, for it is only by the complete cooperation of all arms that success can be attained. This cooperation should nowhere be closer than between the machine gunners and Lewis gunners, whose methods, up to a certain point, are similar, and therefore make mutual understanding easy.

8. *Overhead covering fire*.—Overhead covering fire was used on many occasions, the "Tangent sight method" being that most commonly employed. All ranks should be instructed in the use of



this method, which is of the greatest assistance whenever the control passes from the officer to the No. 1 at the gun. It should be remembered that the "card and string" method, used in conjunction with it, enables the section officer to insure that his No. 1's are preserving the correct "angle of safety."

9. *Emplacements.*—Great care must be taken in deciding whether overhead cover should be provided or not. It must always be remembered that although such cover is of the greatest value against shrapnel and bullets, it is useless against a direct hit from a heavy shell, and that an emplacement which has been detected, either from the enemy's position or from aircraft reconnaissance, will most certainly be subjected to bombardment and probably destroyed. Several instances of this actually occurred during the operations of last August. Many officers mention in their reports that the scrubby "tumps," which are common in some localities, can easily and quickly be converted into emplacements in which guns are quite indistinguishable, and they say that guns which have been brought forward to a "position of readiness" are far safer when kept in these than when on the reverse slopes of hills or in valleys, both of which were always heavily shelled. Light overhead cover on which pieces of scrub were planted would in these cases be of great protection against hostile aircraft reconnaissance. Great care must be taken in cases where emplacements are furnished with overhead cover that the latter is high enough for the cover to be lifted and the lock and feed block removed if necessary. This should always be tested *at once* on taking over emplacements from other troops.

Loopholes should be blinded when the gun is not actually in use. Care must be taken that they are of sufficient size not to restrict the field of fire of the guns.

10. *Horsemanship.*—Since rapid reconnaissance is essential in all machine-gun tactics, officers commanding companies should insure that all their section officers are sufficiently expert horsemen to enable them to make full use of the chargers at their disposal.

11. *Spare barrels.*—Several extemporized methods of carrying the spare barrel were observed. It is absolutely necessary that some dust-proof covering or box should be provided for this article when pack transport is employed.

12. *Sledges.*—Frequent attention is drawn in officers' reports to the long distances which guns had to be carried owing to the lack of cover for transport animals. It is thought that some light form of

sledge might be of use in desert warfare, and experiments in this direction might well be worth undertaking.

13. *Fire.*—An idea appears to have arisen in some quarters that the machine gun is best adapted for enfilade fire, the Lewis gun for direct fire. The second part of the theory is entirely false. Machine guns of whatever description should always attempt to obtain oblique or when possible enfilade fire for which they are peculiarly adapted. The mistake may perhaps have arisen from the fact that the arrangement of guns advocated for the defense of a position is that the machine guns should form the "Belt of fire" while the Lewis guns cover avenues of approach which are, from the conformation of the ground, protected from the fire of the former. This often leads to the Lewis guns having to be employed to bring a direct fire to bear down such approaches, but this is always a matter of necessity and not of choice.

14. *Command.*—As some doubts seem still to exist on the matter the following decision as regards the command of machine-gun sections may be of help to M.G. officers and others: "M.G. sections detached from their company and ordered to cooperate with any body of troops are under the orders of the officer commanding those troops, and the company commander can not move or take away any such sections without the permission of that officer or a direct order from the brigadier. The M.G. company commander may give his advice as to the use or disposition of such sections, but the responsibility as to whether or not he takes that advice rests with the commander of the troops. Sections held in reserve or detailed for special duties are under the orders of the M.G. company commander."

## HOTCHKISS AND LEWIS GUN COURSES.

PART I.—*Instructional.*

[To be fired at a range of 25 yards. Target, Instructional Machine Gun Target, plate 35, Musketry Instructions, Part II.]

No.	Nature of practice.	Rounds.	Method of conducting and object of practice.
1	Holding.....	12	Single shots. To accustom the firer to the gun, and assist in obtaining the correct setting of the Hotchkiss gas regulator.
2	.....do.....	12	Rapid, in two groups of 6 rounds each on different figures. To accustom the firer to the gun, grouping, and correct tension of the return spring. (Hotchkiss gas regulator.)
3	Grouping.....	6	Single shots. To teach importance of consistency of aim and holding.
4	.....do.....	18	Rapid, fired in three spaced groups of 6 rounds each. Each group to be fired at a separate figure. To teach the firer, who in the previous practices has learned the holding and peculiarities of the gun, how to group his shots consistently; and to test his accuracy of holding. A group should not exceed 3-inch ring.
5	Application.....	12	Rapid, in two groups of 6 rounds each; the first group to be fired at the figure named, with regulation aim; the second group at another figure, correcting point of aim, if necessary, in order to bring the group within the band directly over the figure aimed at. To teach the firer how to apply correctly his group to a given target, and to change his point of aim quickly.
6	Distribution by groups (along a line).	30	Rapid, to be fired in groups of 3 to 4 rounds (not spaced), and in two parts of 15 rounds each; left to right 15 rounds, and right to left 15 rounds; each part as it is fired will be criticized separately. To teach the firer to engage a linear target, and to ensure that no spaces of the line are missed. The bipod or barrel rest will be used.
7	Distribution by swinging.	30	Position lying. Two-thirds of the target to be crossed in one continuous burst, evenly and smoothly. The radiator casing or barrel will be rested on a sandbag or parapet.
8	Rectification of stoppages.	50	Position lying. Accuracy of shooting, after rectification, to be criticized.

Total rounds per man: Hotchkiss, 170; Lewis, 152.

Practices 1 and 3 will not be fired by Lewis gunners.

PART II.—*Classification practices 10, 11, and 13 only.*

No.	Nature of practice.	Target.	Range. Yds.	Rounds.	Time. Secs.	Method of conducting.
9	Ranging.....	Plates, iron falling, placed so that they cannot be knocked over. <sup>1</sup>	400	25	.....	The firer will observe his own fire, without outside assistance. Bursts of from 5 to 10 rounds (unspaced) will be fired. When ranging, the sights should be altered between each burst, if necessary. The firer should say "Range" when found, and cease fire.
10	Application.....	Screen 3' × 10'.	400	20	20	The time allowed includes loading. Bursts of about 5 rounds should be fired.
11	Distribution of groups along a line.	Screen 3' × 20'.	300	60	40	10 rounds will be utilized for ranging purposes as in practice 6. Two magazines or strips of 25 rounds each. This time includes reloading. The first 25 rounds will be fired from left to right, the second 25 rounds from right to left. (Fired in bursts of about 5 rounds.)
12	Distribution by swinging.	Screen 3' × 30'. 18 spaces.	200	50	30	Two magazines or strips. The first of 20 rounds, the second of 30 rounds. The time includes reloading, the firing of each swing must be continuous.
13	Snap-shooting..	Figure 3.....	100	<sup>2</sup> 15 <sup>3</sup> 6	<sup>2</sup> 3 <sup>3</sup> 3	The figure will be exposed for 3 seconds at a time. At each exposure 3 to 5 rounds will be fired in the case of the Lewis gun and in the case of the Hotchkiss gun, 2 rounds (single shots). Hits will be signaled as in rifle practices.

<sup>1</sup> See Musketry Regulations, Part II, par. 201.<sup>2</sup> Lewis gun.<sup>3</sup> Hotchkiss gun.

Total rounds per man: Hotchkiss gun, 169 rounds; Lewis gun, 170 rounds.

## CLASSIFICATION.

The firer will be classified on the results of practices 10, 11, and 13.

Points will be allotted as follows:

Practice 10 (application), 20 rounds, 2 points per hit.

Practice 11 (distribution), 50 rounds, 12 spaces, 4 points per space hit.

Practice 13 (snap-shooting), 3 exposures, 4 points per figure hit.

For "first-class" gunner, 70 points.

For "qualified" gunner, 45 points.

NOTE.—Practice 12 may be omitted if time is insufficient for the complete course. The "swinging traverse" should only be taught for use in emergency, e. g., for the repulse of a frontal attack at short range.

### PART III.—*Field practices.*

Practice.	Nature.	Target.	Range.	Rounds.	Objects.
14	Attack	15 falling iron plates on a 15-yard frontage.	Yards. 600 to 400	Sufficient to show effect.	i. Quick change of position and rapid opening of fire. ii. Concealment by the use of existing cover. iii. Method of carrying the gun. iv. Ammunition supply by No. 2. v. Replacement of casualties.
15	.....	5 iron falling plates per gun on a 5-yard frontage.	About 600	.....do.....	i. Rapidity in engaging a target when on the march. ii. Use of hand-cart. iii. Use of existing cover. iv. Quick and correct application of fire. v. Ammunition supply by carts and dumps. vi. Speed in getting out of action.

## NOTES ON METHOD OF CONDUCTING THE PRACTICES.

### PART I.—*Instructional.*

1. *General.*—Since Part I is probably the first time a new Lewis or Hotchkiss gunner fires with service ammunition, careful and thorough instruction is necessary throughout these practices. The best results will be obtained by criticizing each portion of a practice after its completion.

In these practices the firer should learn, as he gains experience, the peculiarities of his gun and its mounting, and after full explanations and criticism, should be able to compensate for them by suitable holding. These points should receive careful attention and explanation by the instructor, and each group fired must be a separate lesson in view of the small number of rounds available for instructional purposes.

2. *Holding practices, 1 and 2.*—(1) *Object.*—These practices teach and demonstrate the following:

- (i) The peculiarities of the bipod;
- (ii) Any peculiarities of the mechanism;
- (iii) The sighting of the gun;
- (iv) Correct tension of the return spring, and setting of gas regulator, which should give a rate of fire of 10 rounds per second;
- (v) Correct holding and position of the firer.

(2) *Points for criticism.*—The instructor watches the firer to see that he holds and fires the gun correctly. Criticisms should take place, both at the gun position and at the target on the completion of each group.

3. *Grouping practices, 3 and 4.*—(1) *Object.*—Having acquired a knowledge of the peculiarities of his gun, the firer in these practices learns how to group shots consistently, and obtains further experience of correct holding, sighting, and adjustment of mechanism and mounting.

(2) *Points for criticism.*—Each group should be fully criticized as it is fired, both at the gun position and at the target. In practice 4 the result of each of the first two groups should be criticized with the aid of field glasses from the gun position. The firer should be taught how to correct his errors.

4. *Application, practice 5.*—(1) *Object.*—Having been taught how to group correctly, the firer now learns how to apply a group accurately to a given target, to change the point of aim quickly, and to correct any errors of elevation and direction. The interval between the first and second group will be only sufficient for a fresh target to be indicated.

(2) *Points for criticism.*—The instructor should take note of the rate of loading, laying, and firing. The previous practice gives the firer a guide as to the elevation. At the target errors due to inaccuracies in laying and elevation should be criticized.

5. *Distribution, practice 6.*—*Points for criticism.*—At the target the following points should be discussed after each part:

- (i) Application;
- (ii) Length traversed;
- (iii) Density of each group;
- (iv) Elevation; and
- (v) Spaces missed.

6. *Swinging, practice 7.*—*Points for criticism.*—At the target the evenness of the distribution of the fire, and its effectiveness, will

be discussed. Attention will be directed to elevation, and spaces missed.

PART II.—*Classification practices.*

7. The practices of Part II will not be fired until the man has fired Part I satisfactorily. In the classification practices 10, 11, and 13, the firer will receive no assistance, and the time limit and methods of loading must be strictly observed. An officer will always be present at the butts, and the usual rules for marking, signaling, etc., will be followed. Failure to fire from whatever cause, other than defective mechanism, will count against the firer. In the case of a breakage of mechanism, the practice will be repeated.

8. Battle sights will not be used, except in practice 12, when their employment is left to the discretion of the conducting officer.

9. *Practice 9.*—A falling plate, or other aiming mark, should be placed well to a flank of each application target and in line with the bottom of the target. Only the actual number of rounds required to find the range should be fired. Rounds thus saved should be used for Part III.

10. *Practice 10.*—The target should be named, but the point of aim must be left to the firer and no assistance given to him; the previous practice should have guided him as to elevation, wind, etc.

11. *Practice 11.*—Only 50 rounds are to be fired at the target. Any surplus of the 10 rounds allowed for ranging will be allotted to Part III. In filling the strips for the Hotchkiss gun, the first five spaces will be missed in the first strip and the last five spaces in the second strip.

12. *Practice 12.*—This practice will be fired from a sandbag or parapet without using the barrel rest or bipod; any position suitable to the available cover will be adopted.

13. *Practice 13.*—The figure will be exposed for three seconds at a time, and from a different part of the trench at each exposure.

PART III.—*Field practices.*

14. *Practice 14—Lewis gun.*—The gunner lies down 50 yards in rear of the first position which should be about 600 yards from the target; No. 2 will lie down about 50 yards to his left rear. On the command "Action" No. 1 will pick up the gun and double forward to the position indicated and open fire. The gun will be carried in the most inconspicuous manner, and the magazine will not be on the gun. On fire being opened, No. 2 will double forward with two magazine carriers having full magazines and lie down under cover to the left rear.

of No. 1. The practice will be continued as above, each advance being about 100 yards. Before the final position, No. 1 should be made a casualty, and on the command or signal to advance, No. 2 will pick up the gun as he doubles forward and fire it from the final position.

*Points for criticism—*

- (i) The pace of the advance, which should be regulated by the distance, and physical condition of the firer;
- (ii) The method of carrying the gun, which should combine freedom of movement and inconspicuousness;
- (iii) The use of cover, and speed in opening fire; and
- (iv) The method of supplying ammunition by No. 2, and his use of cover.

15. *Practice 14—Hotchkiss gun.*—The team (Nos. 1, 2, and 3) will be formed up, mounted, in order of march, 300 to 400 yards from the first firing position.

On the command or signal "Action" they will gallop to a convenient position, affording cover for horses, in rear or to the flank of the firing position. No. 1 will dismount and run to the firing position with the gun and open fire. No. 2 will dismount, take off the ammunition box, and run with it to No. 1, when he will assume his usual position on the right of the gun. The remainder of the practice will be carried out as with the Lewis gun, except that No. 2 should be on the right of the gun when in action. No. 2 will replace No. 1 at the last range.

When the ground is favorable, on the signal "Out of action," No. 3 will bring up the horses at the gallop to No. 2, who will repack the gun, mount, and gallop back to the position originally selected for the led horses.

*Points for criticism.—*

- (i) Selection of position for dismounting;
- (ii) Quickness in opening fire, and use of cover in fire position;
- (iii) Method of advance and use of cover;
- (iv) Ammunition supply and use of cover by No. 2; and
- (v) Speed in getting out of action.

16. *Practice 15—Lewis gun.*—The detachment, with handcarts, will be moving in column of route when they receive word to engage the enemy on their flank. They will move as quickly as possible with the carts to a position which is under cover and is as close to the fire position as tactical conditions allow. A gun and magazine carrier will be taken out of the cart by each No. 1, and two magazine



carriers by each No. 2. The guns will be mounted in a position offering good cover to the firer. No. 2 will take cover to the rear and left flank of No. 1.

Nos. 3 and 4 will arrange for ammunition supply, forming "dumps" where necessary between carts and guns.

"Cease fire" will be given on obtaining effect, and ammunition supply will be practiced. No. 1 may be made a casualty to enable others to fire. On "Out of action" being given, carts will be re-packed and march be resumed.

*Points for criticism.—*

- (i) Time taken to come into action;
- (ii) Undue exposure in coming into action;
- (iii) Use of cover;
- (iv) Method of ammunition supply; and
- (v) Speed in coming out of action.

17. *Practice 15—Hotchkiss gun.*—A similar practice to that of the Lewis gun may be fired, substituting ammunition supply from pack horses, instead of from "dumps." Alternatively, if the ground is favorable, a practice may be framed for a retirement from position to position, two guns working in mutual support. In both cases, the main object is to give practice in bringing the gun into action from the horse, opening fire, and remounting the gun again.

**PART IV.—Advanced field practices.**

The more advanced field practices will take place in close co-operation with a troop or a platoon.

*Total ammunition allowed per man.*

	Hotchkiss gun.	Lewis gun.
Part I.....	170	152
Part II.....	169	170
Repetitions, Parts I and II.....	31	48
Part III.....	80	80
Part IV.....	50	50
Total.....	500	500

---

---

**INFANTRY MACHINE-GUN  
COMPANY TRAINING**  
(PROVISIONAL)

---

**1917**

---

**TO BE READ IN CONJUNCTION WITH INFANTRY  
TRAINING AND MUSKETRY REGULATIONS**

---

**ISSUED BY THE BRITISH GENERAL STAFF**

---

---

# DETAILED TABLE OF CONTENTS FOR INFANTRY MACHINE-GUN COMPANY TRAINING.

CHAPTER I.—ORGANIZATION AND DEFINITIONS.	
Sec.	Page.
1. Organization.....	35
2. Definitions.....	35
CHAPTER II.—PRINCIPLES AND SYSTEM OF TRAINING.	
3. General instructions.....	36
4. Annual training.....	36
5. Elementary training.....	36
CHAPTER III.—SECTION AND COMPANY DRILL.	
SECTION DRILL.	
6. General Rules.....	37
COMPANY DRILL.	
7. General rules.....	37
8. A company in line moving to a flank in column of route, "Action expected".....	37
9. A company in line moving to a flank in column of route, "Action not expected".....	38
10. A company in line advancing in column of sections.....	38
11. A company in column of sections forming line in the same direction.....	39
12. A company in column of route, "Action not expected," forming line facing a flank.....	39
13. A company in column of route, "Action expected," forming line facing a flank.....	39
14. A company in column of route, "Action expected," forming line in the same direction.....	40
15. A company in column of route, "Action not expected," forming line in the same direction.....	40
CHAPTER IV.—MACHINE-GUN DRILL.	
16. Allocation of duties.....	40
17. Elementary drill.....	42
18. Combined drill.....	47
19. Auxiliary mounting drill.....	47

101862°-17-13

LIBRARY

THE GENERAL SERVICE SCHOOLS

FORT LEAVENWORTH, KANSAS

Sec.	Page.
20. Rough-ground drill.....	51
21. Trench drill.....	51
22. Section tactical exercise.....	54

## CHAPTER V.—FIRE DIRECTION.

23. General remarks.....	56
24. Traversing fire.....	56
25. Searching fire.....	57
26. Combined sights.....	58
27. Overhead fire.....	59
28. Indirect fire.....	60
29. Night firing.....	67
30. Indirect overhead fire.....	69
31. Searching reverse slopes.....	72

## CHAPTER VI.—MACHINE GUNS IN BATTLE.

32. Introductory.....	73
33. Characteristics of machine guns and Lewis guns compared.....	74
34. The employment of Lewis guns.....	75
35. The tactical handling of Infantry machine guns.....	75
36. Machine guns in the attack.....	77
37. Machine guns in the defense.....	79
38. Machine guns with an advanced guard.....	80
39. Machine guns with a rear guard.....	81
40. Village fighting.....	81
41. Occupation of various positions.....	82
42. Signals.....	83

## APPENDIX A.

Table I. Tangent elevation, angles of descent, etc.....	84
IIA. Trajectory table.....	84
IIB. Trajectory table for negative quadrant angles.....	86
IIIA. Quadrant angle—Target ABOVE gun.....	88
IIIB. Quadrant angle—Target BELOW gun.....	90
IV. Wind allowances.....	92
V. Allowances for atmospheric influences.....	92
VI. Time of flight.....	93
VII. Searching reverse slopes.....	94

## APPENDIX B.

Indirect overhead fire sheet.....	94
PLATES.....	96

## CHAPTER I.

### ORGANIZATION AND DEFINITIONS.

#### 1. *Organization.*

1. A machine-gun company consists of—

Headquarters.

Sections, each of 4 guns.

The guns may be either Vickers or Maxims, but all the guns of the same company will be of the same pattern.

2. A machine-gun company is commanded by a major or captain with a captain or lieutenant as second in command.

Each section is divided into two subsections, each commanded by a subaltern with a sergeant as second in command. The senior of the two subalterns also commands the section.

3. The machine guns of a section are carried in two limbered G.S. wagons. Each section has also one limbered G.S. wagon for ammunition.

4. Further details as to personnel and vehicles are given in War Establishments.

#### 2. *Definitions.*

The following definitions are added to those given in Infantry Training:

*Band of fire.*—When a machine gun is fired so that the cone of fire is directed on a fixed aiming mark, while the gun is so sighted that the first catch is at the muzzle and the cone never rises above the height of a man, a *band of fire* is formed in the space between the first catch and the first graze. (See Pl. XVII.)

For practical purposes on flat ground, the trajectory limits the length of the band to 600 yards.

*Detachment* (in a machine-gun company).—The number of men detailed for the service of one gun. Each detachment is numbered from 1 to 6, permanent duties being allotted to each number. (See secs. 16 and 17.)

*Fighting limbers.*—Those limbers detailed to carry the guns, tripods, and first supply of ammunition.

*In action.*—A machine gun is said to be “in action” when it is mounted, loaded, and laid, but is not necessarily firing.

*Indirect fire.*—Fire directed at an object or area of ground which is invisible from the gun position.

*Laying.*—The process of elevating and traversing a gun until its axis is made to point in any given direction. On completion of this process the gun is said to be *laid*.

*Machine gun.*—A gun of the Vickers or Maxim type. Lewis guns are not included in the term *machine gun*.

*Position of readiness.*—A position in which guns and personnel are assembled preparatory to coming into action.

*Ranges, terms applied to.*—These are the same for machine guns as for the rifle.

*Screen of fire.*—If machine guns are sited on any given defensive line so that no portion of the ground in front of that line is unswept by at least one band of fire, that front is said to be protected by a *screen of fire*. (See Pl. XVIII.)

---

## CHAPTER II.

### PRINCIPLES AND SYSTEM OF TRAINING.

#### 3. General instructions.

The principles and system of training laid down in Infantry Training, Chapter I, apply to the training of the personnel of machine-gun companies.

#### 4. Annual training.

1. The details given in Infantry Training, section 8, require modification to suit the new organization of machine-gun companies.

2. (a) The establishment given in paragraph 1 of the above-quoted section has been superseded.

(b) Paragraph 2. There will be no brigade machine-gun officer, but when necessary the commander of the machine-gun company attached to the brigade will act as such.

3. Machine-gun companies will, if available, be practiced in field operations with infantry battalions, sections being also occasionally detailed to cooperate with companies of infantry during their training.

#### 5. Elementary training.

The personnel of machine-gun companies are trained as Infantry soldiers in squad drill, as laid down in Infantry Training, before being instructed in the special formations necessary for machine-gun companies which are given in Chapter III of this manual.

## CHAPTER III.

## SECTION AND COMPANY DRILL.

## SECTION DRILL.

6. *General rules.*

1. A section will be exercised in all the movements of squad drill, the word section being substituted for squad.

2. The rules laid down in Infantry Training, Chapter III, for section and platoon drill will apply. It must be remembered that a machine-gun section corresponds to a platoon, and a subsection to an Infantry section.

3. The normal positions of the units of a machine-gun section formed up on parade for inspection are given in Plate I, but a section parading by itself for inspection will fall in with one pace interval between subsections.

## COMPANY DRILL.

7. *General rules.*

1. The object of and rules for company drill of a machine-gun company are the same as laid down in Infantry Training, Chapter IV, for an Infantry company, with the provisos laid down in section 6 (2) of this manual.

2. The normal positions of the units of a machine-gun company in line and in column of route, are given in Plates I, II, and III.

3. The detail of some special movements is given in the following sections.

8. *A company in line moving to a flank in column of route, "Action expected."*<sup>1</sup>

**Move to the right (or left) in column of route. No. — Section leading.**

1. The company commander, company sergeant major, and signalers will take post on the flank nearest the direction of march.

2. The section commanders will give the command *No. — Section, Form-Fours, Right (or Left), Quick—March*, on which the gun limber

---

<sup>1</sup> In this and the following sections the title of the section or of the movement is shown in *italics*, and is followed in the next line by the caution or executive word of command in **boldface type**. The body of the section contains the detail. Cautions or words of command referred to in the detail are in *italics*.

nearest the flank of march will wheel into column of route, followed by its subsection and in succession by the remaining gun limbers and subsections in that order.

3. The ammunition limbers will follow the rear section in the same order as their sections. They will be followed by the headquarters' limber, water cart, cook's cart, and train transport in rear in that order.

9. *A company in line moving to a flank in column of route, "Action not expected."*

**Move to the Right (or Left) in Column of Route, Detachments Leading; Sections, Form—Fours, Right (or Left).**

1. The company sergeant major and signalers will take post at the head of the column.

**Quick—March.**

1. The men of the detachments will act as in squad drill.

2. When the rear of the detachments are clear the subsection officer of the leading section will place himself at the head of the gun limber nearest the direction of march and give the command, *No. — Section, Walk—March*. This limber will be followed by the other gun limber, while the No. 3 limber waits until the gun limbers of the remaining sections have passed. The remaining subsection commanders will act in a like manner in succession.

3. The ammunition limbers, headquarters' limber, water cart, cook's cart, and train transport will follow in that order in rear, supervised by the second in command and the transport sergeant, who will ride in rear of the column.

4. The corporals and other details, as shown in Plate II, will act as brakemen to the fighting limbers and other vehicles, respectively.

10. *A company in line advancing in column of sections.*

**Advance in Column of Sections from the Right (or Left).**

1. The company sergeant major and signalers will take post in front of the section commander on the right (or left) of the line, distances as in Plate I.

2. No. 1 section commander will give the command *No. 1 Section, by the Right, Quick—March*. The remaining section commanders in succession will give the command *No. — Section, Quick—March*, on which they will lead their sections into their places in column in rear of the preceding section.



3. The ammunition limbers will take post in rear of the last section, the limber nearest the flank of direction leading followed by the headquarters' limber, water cart, cook's cart, and train transport.

11. *A company in column of sections forming line in the same direction.*

**At the Halt, on the Left (or Right), Form Line, Remainder Left (or Right)—Incline.**

1. The leading section commander will give the command *No. — Section, Halt*. The remaining sections will incline as ordered, when each section is immediately in rear of its position in line it will receive from its commander, *Left (or Right) Incline*, and, when on alignment, *Halt*. The section commander will, if necessary, give the command *Right (or Left) Dress*, on which the whole will take up their dressing by the flank of direction.

2. The company sergeant major, signalers, ammunition limbers, water cart, etc., will move to their places in line during the movement.

3. This movement will always be done at the halt.

12. *A company in column of route, "Action not expected," forming line facing a flank.*

**At the halt, line to the left (or right), company halt, left (or right) turn.**

1. The men of the detachments will act as in squad drill.

2. The subsection officers and the transport sergeant will lead their wagons to their places in line during the movement, and when the movement is completed will take up their places in line.

3. The company sergeant major, signalers, servants, cooks, etc., will take up their places in line during the movement.

13. *A company in column of route, "Action expected," forming line facing a flank.*

**At the halt, facing left (or right), form line.**

The leading gun limber will wheel in the named direction and halt, followed by the remaining gun limbers, which will wheel and halt in succession as they arrive at the correct interval. They will be followed by their respective subsections, which will be led to their places in line by their subsection sergeants, who will give the command *Halt, left (or right) turn*.

2. The company sergeant major, signalers, ammunition limbers, headquarters' limber, water cart, cook's cart, and train transport will move to their places in line during the movement.

14. *A company in column of route, "Action expected," forming line in the same direction.*

**At the halt, on the left (or right), form line.**

The leading gun limber will halt, the remainder disengaging to the left (or right) and taking up their places in line. As the gun limbers arrive at their places, their respective subsections will disengage by the right. On reaching the correct distance in front of the gun limbers, each subsection sergeant will give the command *At the halt, on the left (or right), form subsection.*

2. The company sergeant major, signalers, ammunition limbers, headquarters' limber, water cart, etc., will move to their places in line during the movement.

15. *A company in column of route, "Action not expected," forming line in the same direction.*

**At the halt, on the left (or right), form—Company.**

1. The men of the detachments will act as in squad drill.

2. The gun limbers will be led to their places in line by their respective subsection officers.

3. The company sergeant major, signalers, cooks, servants, etc., ammunition limbers, headquarters' limber, water cart, cook's cart, and train transport will move to their places in line during the movement.

---

## CHAPTER IV.

### MACHINE GUN DRILL.

NOTE.—The following sections 16 and 17 are substituted for sections 102 and 103, respectively, in Infantry Training, Chapter VII. Additional sections, 18 to 22, are added for more advanced training. In order that training may be progressive, the sequence of these sections should be adhered to.

#### 16. *Allocation of duties.*

1. The duties of the section commander are to command the section in accordance with his orders and the tactical situation, to select gun positions, to observe and to control fire generally, to regu-

late the ammunition supply, and to give instructions regarding the movements of limbered wagons.

2. The duties of the subsection officer are to assist the section commander and to act as second in command of the section. He should be ready to replace the section commander should the latter become a casualty. Normally he will command one subsection in action and supervise the transport of his section in quarters and on the line of march.

3. The duty of the sergeant is to supervise guns coming into action as the section officer may direct. He must be prepared to take command of the section in the event of both the officers becoming casualties. He is responsible for replacing casualties among the gun numbers when they occur.

4. The corporal is responsible generally for the packing and contents of the gun limber. On the line of march he marches behind it and works the brake as required. On the order to unpack he will superintend the unpacking, and take command in the absence of the section officer or sergeant. He will have the spare parts box handy, supervise the ammunition supply and filling of belts, direct the gun limber as required, superintend the filling of sandbags, and watch for signals from the section officer. He will be prepared to take the place of the sergeant should he become a casualty.

5. The following are the duties of the various numbers:

No. 1 is the firer. He will personally clean and look after his gun and insure that the mechanism is working smoothly. On going into action he will carry the Mark IV tripod and place it in a suitable position and assist No. 2 in mounting the gun. He repeats all orders received, observes his own fire when possible, and makes the necessary alterations of elevation and direction.

No. 2 assists No. 1 at the gun, carries the gun into action when No. 1 is carrying the tripod, and mounts it with the assistance of No. 1.

On going into action he will secure the tube of the condenser to the gun and take the first-aid case. In action he will attend to the feeding of the gun, watch for signals from the section or company officer, and generally assist No. 1.

No. 3 is responsible for keeping the gun supplied with ammunition, seeing that the condenser (half filled with water) reaches the gun position before there is any chance of the water in barrel casing boiling, and carrying out minor repairs while the gun is in action.

No. 4 assists No. 3 in his duties. He is responsible for keeping No. 3 supplied with ammunition, water, and spare parts from the spare-parts box as required.

Nos. 5 and 6 are spare men. These numbers and the scout and range taker, if detailed to the section, act according to the orders of the section or subsection officer.

6. Section officers will insure that each man of the section is thoroughly trained in the duties of each "number." A system of "changing round" will be arranged, so that every man will perform the several duties of the section in turn.

### 17. *Elementary drill.*

NOTE.—Elementary drill consists of the following:

- (a) Mounting the gun.
- (b) Loading.
- (c) Sight setting and laying.
- (d) Unloading.
- (e) Dismounting the gun.
- (f) Coming into action.
- (g) Coming out of action.
- (h) Tap traversing and vertical searching.
- (i) Use of condenser tube and bag with water.
- (j) Elementary drill with gun mounted in lowest position.

1. The guns of a subsection, with tripods and ammunition boxes, will be placed on the ground, muzzles to the front and in line, legs to the rear, and clamps sufficiently tight to prevent the legs from hanging loose when the tripod is lifted off the ground. The traversing clamp should be sufficiently loose to enable the gun to be deflected by a sharp tap with the hand on the rear crosspiece; guns on the right, ammunition boxes 3 paces in rear of the guns. The guns should be a convenient distance apart, but not closer than 8 paces.

2. On the command *Fall in*, the subsection will fall in in two ranks, 5 paces in front of the interval between the two guns, the sergeant on the left of the front rank, covered by the corporal in the rear rank. The front rank will provide the right gun detachment, the rear rank the left gun detachment.

On the command *Number*, the subsection will number from right to left.

On the command *Take post*, detachments turn outward and double to their respective guns (the sergeant and the corporal on the outer flank, where they can superintend). Nos. 1 and 2 fall in on the left of the tripod and right of the gun, respectively, No. 3 on the left of the ammunition box. If the ground is suitable, these numbers should lie down.

Nos. 4, 5, and 6 should take up positions as directed by the instructor.

3. Before commencing drill, each "number" will examine the gun and equipment as follows:

No. 1 will examine the tripod and see that—

- (a) The legs are closely folded and clamped.
- (b) The traversing clamp is *sticky*.
- (c) The pins are in and turned down.
- (d) The elevating screws are exposed the same amount.

No. 2 will examine the gun and see that—

- (a) The lock is in and the lock spring is released.
- (b) The sliding shutter is closed (in the Vickers gun).
- (c) The feed block is in and the front cover catch of the Vickers gun turned down.
- (d) The T fixing pin is screwed up and vertical (Vickers gun).
- (e) The cork plug is in.
- (f) The slide of the tangent sight is adjusted to 600 yards.
- (g) The auxiliary mounting is correctly fixed and in working order.

No. 3 will examine the belt and see that—

- (a) The cartridges are correctly placed.
- (b) The belt is packed correctly in the box and the lid fastened.

Nos. 2 and 3 will report to No. 1 when they are satisfied that all is correct.

4. In each stage of the drill the correct method will first be demonstrated by the instructor, and will then be practiced by each member of the team before proceeding to the next stage. During drill, the spare numbers will be brought up near the gun to watch and listen to the criticism. No. 1 will always repeat the words of command loudly and clearly.

5. *Mounting the gun.*—A machine-gun instructional target or landscape target will be placed about 25 yards from the guns. The instructor will point out a place for the guns to be mounted, not more than 5 yards from where they are lying. He will then give the command *Mount gun*.

No. 1 picks up the tripod, carries it to the spot ordered, and places it in position. In adjusting the tripod he must insure that the socket is upright and that the legs are clamped tight. He must learn by experience *the adjustment that suits him best for the position ordered and for the nature of the ground, so that he will not be cramped when firing and will not have to alter the tripod after the gun has been mounted.*

As soon as the tripod is nearly in position, No. 2 picks up the gun (with Vickers gun pushes the sliding shutter to the rear), and carries it to the right side of the tripod holding the rear crosspiece with the left hand with the gun muzzle to the rear under the right arm. He then kneels on the left knee, facing the tripod, and supporting the gun on the right knee places it on the tripod, drives in and turns down the crosshead joint pin, and removes the cork plug from the steam escape hole. No. 1 fixes the elevating joint pin, and directs the gun toward the mark. Meanwhile No. 2 lies down and places the ammunition box in position.

No. 2 should time his advance so as to reach the tripod at the moment its adjustment is completed.

When No. 3 sees that the gun is nearly mounted, he carries the ammunition box forward and places it within reach of No. 2. The ammunition must be at hand directly No. 2 is ready for it. No. 3 then retires to a position not immediately in rear of the gun. (Standard time, 20 seconds.)

6. *Loading.*—On the command *Load*, No. 1 pulls the crank handle on to the roller. (Maxim: Turns the crank handle on to the buffer spring.) No. 2 passes the tag of the belt through the feed block. No. 1 with his left hand pulls the belt straight through to the left front as far as it will go and releases the crank handle. Relaxing the strain on the belt, No. 1 pulls the crank handle on to the roller (Maxim: Turns the crank handle on to the buffer spring), pulls the belt to the left front and releases the crank handle. Each motion should be clean and distinct. (Standard time, 5 seconds.)

The gun is now loaded and ready to fire.

7. *Sight setting.*—For ranges not exceeding 500 yards the fixed sight will be ordered, except when firing at a very small target, when orders will be given as in the case of ranges over 500 yards.

For ranges over 500 yards, on the command (*Range*), e. g. "900." No. 1 raises the tangent sight, repeats the order for his own gun, and adjusts the slide to the elevation required for the distance ordered.

8. *Laying.*—On the command *At* — (naming the aiming mark), No. 2 adjusts the traversing clamp if told to do so by No. 1, and No. 1 lays the gun, maintaining the same pressure on the handles while laying as he would when firing.

When the gun is laid, No. 1 raises the automatic safety catch with the forefinger, and prepares to fire. When No. 1 is ready, No. 2 holds out his left hand and arm horizontally.

9. As proficiency increases, the pause between naming the range and the aiming mark should be slight. (Standard time for sight

setting and laying, 12 seconds; taken from the time the range is ordered until No. 2 holds out his hand.)

10. On the command or signal *Fire*, No. 1 presses the thumbpiece or double button.

11. On the command or signal *Cease fire*, No. 1 releases the pressure on the thumbpiece or double button, and remains steady.

12. The points for criticism when the gun is mounted should follow a definite sequence.

(a) *Tripod:*

- i. Position of legs with reference to the ground.
- ii. Clamps of leg tight.
- iii. Socket upright.
- iv. Traversing clamp *sticky*.
- v. All pins in and turned down.
- vi. Elevating screws equidistant.
- vii. Rear leg in prolongation of line of sight to the target.

(b) *Gun:*

- i. Muzzle toward the target.
- ii. Cork plug out.
- iii. Shutter back.
- iv. Belt box in line with the feed block.
- v. No. 1 with holding taken and elbows supported on thighs.
- vi. No. 2 in position.
- vii. Gun fairly level.
- viii. Tangent sight set to 600 yards.

(c) The following points should also be noted:

- i. Loading; the cleanness of loading must be insisted on.
- ii. Accuracy of sight testing.
- iii. Absolute accuracy of aim.
- iv. Firing; that on the order or signal being given, to open fire, the double button or thumbpiece is immediately pressed, without disturbing the laying.

13. *Unloading.*—On the command *Unload*, No. 1 lowers the tangent sight, if it has been raised, and leaves the sight as last adjusted; he pulls the crank handle twice in succession on to the roller, letting it fly back each time on to the check lever, and finally depresses the lower pawls (Maxim: He turns the crank handle twice in succession on to the buffer spring, letting it fly back each time on to the check lever) while No. 2 withdraws the belt and packs it in the box; this must be done correctly, and the lid closed and fastened; No. 1 releases the lock spring by pressing the double button or thumbpiece. (Standard time, 5 seconds.)

14. *Dismounting the gun.*—On the command *Dismount gun*, No. 1 removes the elevating and crosshead joint pins.

No. 2 passes the ammunition box to No. 3, replaces the cork plug when the condenser is not in use, removes the gun as in mounting, and replaces it in its original position in rear. On reaching this position, he closes the sliding shutter (Vickers), and readjusts the tangent sight to 600 if previously altered.

No. 1 carries back the tripod, replaces the cross-head and elevating joint pins, taking care that they are turned down, and then folds and clamps the legs. (Standard time, 15 seconds.)

15. *Coming into action.*—As proficiency increases, the gunners should be exercised in performing all the movements required to bring the gun into action.

On the command or signal *Action* (followed by range and aiming mark) the gunners will, from the positions described in paragraph 2, combine all the foregoing details of mounting, loading, and laying the gun, No. 2 signifying when No. 1 is "ready" to fire. (Standard time, 35 seconds.)

16. *Coming out of action.*—On the command or signal *Out of Action*, the gun will be unloaded without withdrawing the belt from the feed block. No. 1 will seize the rear leg and rapidly withdraw the gun and tripod under cover or to the original position, with the least possible exposure. No. 2 similarly will withdraw the ammunition box. The gun will then be dismounted in the usual manner. If the cover is some distance away, Nos. 1 and 2 will carry the gun, tripod, and belt box in the most convenient manner to cover.

17. *Tap traversing.*—Frequent instruction will be given in traversing fire. The firer must first insure that the traversing clamp is just sufficiently loose to enable the gun to be deflected by means of a sharp tap with the hand on the rear crosspiece. Each man must learn by experience the exact degree of clamping he requires, and before firing he should insure that the clamp is correctly adjusted to suit himself.

Traversing fire is applied by means of a series of groups fired at intervals within certain limits indicated by such figures on the machine gun instructional target as may be ordered by the instructor.

The procedure for horizontal traversing is as follows: The instructor having described the figures between which fire is to be directed, will give the command *Traversing* followed by the signal to fire. The firer will lay the gun on the flank figure named and press the button, then tap the gun approximately to the center of the interval to the next figure, again press the button, then tap, and so on, until



the limit ordered has been reached. The firer should be taught to fire groups of about eight rounds by maintaining pressure on the button for about one second at each group. By this method he will learn to tap the gun with the necessary force in order to avoid firing more than one group at the same place, and also to avoid leaving gaps in the line he is traversing. (Standard time, 2 seconds for each completed series, i. e., a group and completed traverse.)

As proficiency increases, instruction should be given in diagonal traversing. In this case the target will be three bands each with three figures as for horizontal traversing. The bands will be joined so that each of the outer bands is in the same vertical plane as the center band and forms an angle of  $120^\circ$  with it.

In this case the firer is taught to combine the use of the elevating wheel with tapping for deflection, the same principles being applied as in horizontal traversing. Instruction should be afforded in traversing from right to left as well as from left to right.

During instruction, fire should be stopped at least twice in order to check the laying and also to measure the distance traversed. By comparing the distance traversed with the groups fired, an estimate can be made as to the value of the traversing fired. For example: Traversing fire is ordered from the first to the sixth figure; fire is stopped after the fourth group. If the traverse had been correctly carried out, the gun should be laid on the interval between the second and third figures. (Standard time, 3 seconds for each completed group and traverse.)

18. *Swinging traverse.*—Against dense targets at close range, the normal method of traversing is too slow, and fire is unnecessarily concentrated. The “swinging traverse” will therefore be employed for this purpose. This consists of rapidly traversing a given line with the traversing clamp loose, the limit and speed of traverse being controlled by the action of the gunner.

Elementary instruction in “swinging traverse” will be given on the machine gun instructional target. The gunner will be trained to traverse evenly and smoothly the breadth of the target from outside figure to outside figure in about 5 seconds.

As proficiency is attained, practice will be afforded in traversing various types of targets which are suitable for this method of fire.

### 18. Combined drill.

Instruction in machine-gun signals (see Infantry Training, sec. 164) must be given before combined drill is commenced, and these signals should henceforth be used whenever possible.

Combined drill is best carried out with four or more guns. Condensers will always be attached and bags filled. Barrel casings will also be filled. Competition between detachments should be encouraged with a view to increasing proficiency in elementary drill. The following subjects are taught during combined drill:

- (a) The execution and delivery of fire orders.
- (b) The use of combined sights.
- (c) Indication and recognition of targets.
- (d) Immediate action.
- (e) The replacement of breakages.
- (f) Casualties.

The instructor should take times, correct mistakes, and carefully note the performance of each detail. When combined drill is carried on out of doors in fine weather, all numbers should lie down, 3 and 4 forming a short chain, and the remainder representing reserves in the rear.

#### 19. *Auxiliary mounting drill.*

1. The auxiliary (light) mounting is not intended to replace the Mark IV tripod. The gun can be placed on the Mark IV tripod without removing the light mounting.

It is intended for use in—

- (a) The firing line.
- (b) Rapid advances.
- (c) Trench to trench rushes.
- (d) Fighting in captured trenches when hurried changes of position are essential, etc.
- (e) Trench fighting, when the gun has to be fired hurriedly from a position other than the battle emplacement, or when the Mark IV tripod has been destroyed.

The gun can be carried by either one or two men, as desired. The leather straps, one on the rear crosspiece and one on the front clip band, enable Nos. 1 and 2 to carry the gun between them. They should move in single file, thus concealing the gun from the front. In this way the fact that a machine gun is being brought up will be more easily concealed from the enemy.

When in action in the open with the light mounting, No. 1 should lie on his back, with his legs to the left of the tripod, No. 2 being on his right-hand side, supporting the firer's back and neck with his legs. (See Pl. VII.)

2. When it is desired to have the gun carried by one man, Nos. 1 and 2 should move extended to two or three paces, but conform-

ing as far as possible to neighboring infantry extensions, No. 1 carrying the gun and No. 2 two or more boxes of ammunition and first aid case.

3. The following method will be taught in addition to other methods which may be suitable on special occasions. The gun will be carried vertically on the right-hand side, muzzle upward, the right hand grasping the rear leather band, back of the hand to the front, and taking all the weight; the left hand steadying the muzzle end by means of the light mounting clip.

The method of carrying the gun on the shoulder leads to exposure, and is unsuitable in trenches or when in close contact with the enemy.

The condenser tube will be attached throughout.

4. (a) For drill purposes about 3 seconds after No. 1 has opened fire he should pull the crank handle on to the roller, thus allowing the short length of belt to be pulled through the feed block and the web belt inserted.

(b) The fixed sight is invariably used in light mounting work; consequently the tangent sight will not be raised.

(c) Stoppages should be practiced.

(d) When this drill is carried out on rough ground the necessary precautions for concealment will be observed when bringing the gun into and out of action.

5. *Drill with "two-man load."*—The gun, with light mounting attached, legs closed and engaged in the clip, will be placed on the ground 20 yards in the rear of the selected position upon which the gun is to be brought into action.

The muzzle of the gun will be placed to the front.

Nos. 1 and 2, each with an ammunition belt box containing a few dummy cartridges at the end of the belt, will assume the prone position, No. 1 behind the rear crosspiece, No. 2 on the right of the gun. No. 2 will have also a short length of belt with two dummy cartridges in its leading end, and the first aid case.

The condenser bag will not be carried.

6. On the caution *Prepare to advance*.—No. 1 will—

(a) Pull back the sliding shutter.

(b) Perform the first half of the loading motion.

(c) Throw the short length of belt over the feed block to the left.

(d) Release the lock spring.

(e) Turn the gun on its left-hand side.

No. 2 will—

- (a) Insert the short length of belt in the feed block.
- (b) See that the front leather strap is to the top.
- (c) Open the tripod legs after (e).

7. On the command *Action*, the numbers spring to their feet seizing the appropriate straps, and, each carrying a belt box in the disengaged hand, will move rapidly to the position selected. No. 1 has the strap in his right hand; No. 2 in his left hand.

8. On arrival at the position, No. 1 will call out *Action* and—

- (a) Steady the tripod and lie down, placing the belt box in a convenient position for No. 2.
- (b) Throw the short length of belt over to the right and complete the loading motions.
- (c) Adjust the rear leather strap if necessary.
- (d) Open fire.

No. 2 will—

- (a) Turn down the front leather strap.
- (b) Lie down and support No. 1.
- (c) Open the belt box and hold a new belt ready.

9. On the caution *Prepare to advance*, preceded by the command *Cease fire*, No. 1 will unload; No. 2 removes the web belt and inserts the short length of belt, if there has been time to replace it.

10. On the command *Out of action*, the gun will be unloaded without removing the belt from the feed block and will be withdrawn until cover is reached, when No. 1 will—

- (a) Depress the pawls and release the lockspring.
- (b) Close the sliding shutter.

No. 2 will—

- (a) Pack away the belts.
- (b) Adjust the front strap.

Both will then jump up and retire, carrying the boxes and gun.

11. *Drill with "single load."*—As for drill with the two-man load, except that No. 2 will carry both belt boxes.

12. On the caution *Prepare to advance*, the same procedure will be followed as for the two-man load, except that No. 2 should see that the front strap is at the *bottom*.

13. On the command *Action*, as for the two-man load, except that No. 1 carries the gun alone; No. 2 the belt boxes. In moving forward, No. 2 should extend to the right, and close in again on No. 1 on nearing the position.

The remainder of the drill follows the same lines as for the two-man load.

**20. Rough ground drill.**

1. The gun will be mounted throughout on a steep slope, for firing in each of the following directions in turn:

- (a) Down.
- (b) Up.
- (c) Horizontally to the right.
- (d) Horizontally to the left.

Nos. 1, 2, and 3 with the gun, tripod, and ammunition box, and 4 with water bag (full) and another box of ammunition, will be in a position of readiness not more than 10 yards from the selected position. The instructor having marked the position and pointed it out, the gun numbers, on receipt of a target and range, will, on the order *Action*, mount, load, and lay the gun on the target indicated. The same procedure will be followed for each of the four positions.

2. The following points are important:

- (a) Correct setting up of the tripod, the rear leg always downhill.
- (b) The positions adopted by Nos. 1 and 2 (as regards fire effect, exposure, and comfort).
- (c) The position of the ammunition box to insure correct feed.
- (d) The position of No. 3 (minimum exposure with facility for supply).
- (e) The position of No. 4.
- (f) The gun must be properly in action, and all details of elementary training must be observed.

**21. Trench drill.**

1. The object of trench drill is to practice:

- (a) Posting and relieving sentries and No. 1.
- (b) Relieving detachments.
- (c) Action in trenches.
- (d) Preparing to advance and coming into action.
- (e) Quick change to an alternative position.

All the above should be practiced on the barrack square before drill takes place in the trenches.

2. *Posting and relief of sentries and No. 1.*—The principles involved are identical with those of posting and relief of an infantry sentry on guard or outpost duty.

3. At a gun position in trenches:

- (a) *By day* only one number need be on duty at the gun position, and he will be the sentry.

(b) *By night* two men will always be on duty; one being the sentry, who is keeping a lookout, and the second being the No. 1 for the term of duty. The latter is actually at the gun, and may sit down, but must be awake.

4. A gun number (if by night, usually the last number on gun duty) will be posted as a sentry—by day with a periscope or at a loophole if no periscope is available; by night, looking over the parapet. He will be acquainted with the position of all emplacements allotted to his gun, and will have a thorough knowledge of the following:

(a) The section of the ground covered by the gun which it is his duty to watch.

(b) Points shown on the range card.

(c) Special orders for his gun position during his relief. These may include action as regards patrols, wiring parties, etc.

(d) Standing orders for the sentry on machine-gun emplacements.

He will be informed of any unusual circumstances noticed by his predecessor.

The relieving No. 1 will inspect the gun and insure that the gun is in firing order, also that all necessary equipment is in place. He will be informed of any special fire orders which may have been issued for that gun.

All the foregoing is applicable to internal relief within a gun detachment. For relief of sentries when sections or companies are concerned see paragraphs 5 and 6.

5. *Relief of detachments.*—The guide with the relieving detachment will lead them to the dugout of the detachment to be relieved, and report to the gun commander of that detachment that the relieving detachment has arrived.

The relieving N. C. O. or man in charge will—

(a) Ascertain the positions of the gun, the sentry, alternative emplacements, his officer's headquarters, the nearest telephone, and the latrine.

(b) Take over and give a receipt for trench stores.

(c) Receive a report from his No. 1 when his gun, etc., is present and correct.

(d) Ensure that his No. 1 understands his orders, range card, etc., for his gun, and show him the alternative emplacements.

(e) Order his No. 1 to mount his tripod (and gun, if relief is by night), and see that this is done correctly.

(f) Detail his first sentry, and instruct him to take over.

(g) Report to his officer, "Relief complete."

(h) Draw out a duty roster.

6. The relieving sentry will ascertain the orders for the sentry as detailed in paragraph 4, and, in addition, will find out—

(a) Whether the gun has been fired during the previous relief.

(b) If so, at what target, and from what emplacement.

7. The officer in charge of the relieving detachment will—

(a) On arrival in the trench sector to be defended by his guns, report to the officer of the guns to be relieved.

(b) Remain with him and receive reports from his gun commanders.

(c) Receive any instructions or information with regard to the situation, other than those he has learned during his previous reconnaissance.

(d) As soon as the relieved detachment has moved off he will go round all his guns and make sure that his gun commanders have carried out their work correctly. At the same time he will see that any special orders he may have issued with regard to work to be done, standing fire orders, etc., are being complied with.

(e) Report "Relief complete" to his machine-gun company commander and to the company commander of the trench sector in which he finds himself.

(f) See that his arrangements for communication are on a satisfactory basis.

8. Officers in charge of detachments relieved will not move off until their detachments are reported closed up and complete.

#### ACTION IN TRENCHES.

9. (a) *By day*.—On the command *Action*, the sentry runs to the dugout, wakes the other members, takes the gun to the emplacement, mounts, loads and lays; No. 2 follows immediately with the ammunition and first-aid case, and the remaining members stand by in the dugout. When the occupants of the trench are ordered to *Stand-to*, the above procedure is carried out by the machine-gun detachments, except that the gun is only half loaded.

The loophole (if blinded) would have to be cleared before fire could be opened; the actual moment when this should be done depends on the nature of the situation.

(b) *By night*.—On the command *Action*, No. 1 will complete the loading motions. The sentry will waken the men in the dugout and return to his post.

(c) Practice should be given in mounting the gun on the auxiliary mounting in alternative positions during drill by day to represent the Mark IV mounting having been destroyed.

Practice will also be given with the pivot and ammunition box mountings.

PREPARE TO ADVANCE.

10. (a) *By day*.—The sentry will run to the dugout and warn the other numbers. Nos. 1 and 2 will carry out their duties as laid down for the caution *Prepare to advance* in "Auxiliary Mounting Drill." (Sec. 19 (6).) After this is completed they will carry the gun from the dugout to the correct place in the trench. No. 3 will come up and dismount the tripod.

(b) *By night*.—Nos. 1 and 2 will be in their proper positions (see par. 3), spare parts, short length of belt, and two belt boxes in the emplacement, spare numbers in the dugout. On the command *Prepare to advance*, No. 1 will unload, withdraw the web belt, insert the short length, perform half the loading motions, throw the short length over the feed block and release the lock spring; while No. 2 warns the spare numbers in the dugout. The latter then returns to the gun, helps No. 1 to dismount, opens the auxiliary legs, and both adjust the leather straps. The gun is then brought to the easiest place from which to climb over the parapet, two belt boxes, spare parts, etc., being brought with it. No. 3 dismounts the tripod when the emplacement is clear, and awaits further orders.

(c) On the command *One-man load, Action*, or *Two-man load, Action*, either by day or night, Nos. 1 and 2 will act as laid down in section 19, (7) and (8). No. 3 will assist Nos. 1 and 2 with their equipment over the parapet.

(d) At this stage the instructor may either—

- (i) Give the command *Out of action*, on which the gun numbers will retire with the gun to their original position, or
- (ii) Order No. 3 to advance with Mark IV tripod and mount it near Nos. 1 and 2, taking care that there is no crowding of men.

22. Section tactical exercises.

1. Section tactical exercises will include all details of training that a section of machine guns should receive from the section officer. If these exercises are carefully prepared and executed, the section officer on service will be relieved from the necessity of supervising the detailed execution of his orders, and will be left free to devote his attention to the general situation, while maintaining control of the movements and actions of his guns.



2. *Exercises with one gun.*—The position of readiness will be not closer to the gun position than about 50 yards. Instead of indicating the exact position on which the tripod will be set up the instructor will mark two points about 30 yards apart, between which the gun will come into action. The ground selected should afford practice in firing in the positions described in rough ground drill (sec. 20). Whenever possible there should be only one small portion of the prescribed frontage from which the objective can be seen when the gun is in action. By this means the detachment will be practiced in selecting suitable gun positions to meet the particular requirements of the situation, and thus develop an eye for ground.

In these exercises attention will be paid to the following points:

(a) The use of ground to obtain the greatest possible concealment in approaching the gun position from the position of readiness. This should be kept in mind by the instructor in selecting positions.

(b) The method of approach to the gun position as regards carrying the gun, tripod, and ammunition box. Concealment is of greater importance than rapidity within reasonable limits.

(c) Proficiency in the lessons taught in rough ground drill. Observers will be sent out to note visibility in the approach, in mounting, and when the gun and detachment are in action.

3. *Exercises with two guns.*—The entire subsection will be exercised with two guns on the same progressive lines as those laid down in paragraph 2. The actual position of each gun will be marked by the instructor in order to bring out the handling of the section with reference to the ground and the requirements of the situation. The tactical situation should be described in greater detail than is necessary for elementary drill purposes in order to employ scouts and range takers in a realistic manner. A simple tactical situation should be given and ranges actually taken. The position of the gun limber, of which the corporal will be in charge, will be represented by a hand-cart or indicated by a flag. The supply of ammunition will be actually carried out, empty boxes being returned. The men will be changed around at intervals so that each may be exercised in the duties of the various numbers.

4. The points to be attended to in rough ground drill (sec. 20) and in tactical exercises with one gun (par. 2) should be carefully observed and the performance criticized.

5. Further instruction should be given by carrying out a certain number of elementary tactical exercises, involving all duties of machine-gun section or subsection establishments, with a view to

developing cooperation between the gun numbers and initiative. These exercises should comprise movements of various kinds over a wider stretch of country than hitherto attempted. Complete exercises should be prepared in detail, with maps, instructions, and points for criticism.

When possible, trained men should be used to demonstrate the methods employed.

6. Schemes should also be framed for the purpose of training machine-gun officers in the tactical principles laid down in Infantry Training and Field Service Regulations, as well as those given in this manual, and in Notes for Infantry Officers on Trench Warfare. These exercises should involve the rapid appreciation of a situation, the issue of orders to meet the situation, and the control of machine guns.

The actual presence of guns on such tactical schemes is of value, in order to test to some extent the feasibility of the execution of the orders given. The presence, however, is not essential for the conduct of the exercise.

---

## CHAPTER V.

### FIRE DIRECTION.

#### 23. *General remarks.*

1. The theory of rifle fire and its practical application discussed in Chapter III of the Musketry Regulations is equally applicable to the fire of machine guns, due regard being had to the greater concentration or closer grouping of shots produced by the fire of a machine gun than by the fire of an equivalent number of rifles.

2. The principal methods of machine-gun fire are dealt with in Infantry Training, section 163. Some further methods are given in this chapter.

3. It must be remembered that these methods are not suitable for Lewis guns, but only for machine guns fired from a fixed platform, such as the Mark IV tripod.

4. Various tables for use in these methods of fire are given in Appendix A.

#### 24. *Traversing fire.*

1. The principles of traversing are taught during elementary gun drill and during the annual and general machine-gun courses. (See also Infantry Training, sec. 163 (1) (iii).)

2. This method of engaging a linear target possesses certain disadvantages. It is a slow method and requires careful training, and the regularity of the groups may possibly detract from the effect produced on the target. The former can be remedied to a great extent by seeking opportunities for oblique fire, thus reducing traversing to a minimum. Fire effect from this very systematic form of traversing may be lost owing to the enemy anticipating where the next series of groups will fall. This can be overcome if the gunner is trained to apply series of groups at different parts of the linear target in turn.

3. An alternative method is the "swinging traverse," the traversing clamp being kept fairly loose, and the gun swung evenly and smoothly from side to side. This method may sometimes be found necessary against dense targets at close range, when the normal method would be too slow.

Using this method, a gun can distribute fire over approximately 30 yards of front in five seconds at close ranges.

#### 25. *Searching fire.*

1. The principles of searching are demonstrated in Part I of the Annual and General Course for Vickers, Maxim and Colt Guns. It is used when only one or two guns are available or combined sights will not overcome ranging errors. It requires much skill on the part of the firer to avoid gaps. The size of the groups fired will depend on the nature of the target engaged.

2. When one gun is being employed in "searching" the sights are adjusted so that the first group will include the lowest limit of range to be searched, which is dependent on the probable error to be expected in estimating the range. The gun is then laid on the aiming mark, and the sights adjusted without relaying, so that the last group will include the highest limit of range. The line of sight will now strike the ground short of the aiming mark. (See Pl. XXII.) A group will now be fired, after which the elevating wheel will be so turned as to cause the next group to strike sufficiently far beyond the first to insure an overlap. This is continued until the line of sight is again brought on to the aiming mark.

3. When using two guns the left gun will act as described above; the sights of the right gun will be adjusted in the first instance to the highest limit, and will work down to the lowest limit. (See Pl. XXIII.)

4. Searching will be discontinued if observation of results is obtained.

5. The effect of ground rising with respect to the line of sight must be considered when combined sights or searching is employed. (See Musketry Regulations, sec. 187.)

6. Combined sights, searching, or a combination of both can also be used for engaging targets of great depth, such as roads, bridges, etc.

### 26. Combined sights.

Combined sights is a method of increasing the beaten zone by ordering two or more guns to engage the same target with different elevations. It can be used to engage targets of great depth, or it may be employed to insure that the target shall fall within the beaten zone, when the range to the target is uncertain. (See Pl. XXI.)

The table below shows the number of guns required, and the differences for 5 per cent, 10 per cent, and 15 per cent errors in ranging. The table is not extended to include a larger number of guns than four, as on service a section would most probably be the largest unit under the control of a single fire commander.

*Combined sights table.*

75 per cent effective beaten zone.				90 per cent effective beaten zone.			
Estimated range.	Error in ranging.	Least number of guns.	Differences between guns.	Estimated range.	Error in ranging.	Least number of guns.	Differences between guns.
	<i>Per ct.</i>				<i>Per ct.</i>		
700 and 800.....	15	2	100	1,000 and 1,100..	15	2	100
900 and 1,000...	10	2	100	1,200 and 1,300..	10	2	100
	15	3	100		15	3	100
1,100.....	10	3	100	1,400.....	10	3	100
	15	4	100		15	4	100
1,200.....	5	2	50	1,500.....	5	2	100
	10	4	50		10	3	100
1,300.....	5	2	50	1,600.....	5	2	100
			50		10	3	100
1,400, 1,500, and	5	3	50	1,700 to 2,000,	5	2	100
1,600.....			50	inclusive.....	10	4	100
1,700 to 2,100....	5	4	50	2,100 and above.	5	2	100

The number of variables in the table above makes it difficult to lay down any accurate rule for the employment of combined sights. For average service conditions the following will be found to give good results.

**RULE.**—Always use as many guns as possible: With 100 yards differences, if error in ranging is probably considerable; 50 yards differences if error in ranging is probably small.

*27. Overhead fire.*

1. Overhead fire with machine guns may be employed under certain conditions. The following factors, all of which tend to increase the difficulty and risk, necessitate the working out of a reasonable margin of safety:

(a) The state of the barrel.

(b) The condition of the tripod and the nature of the ground on which mounted.

(c) The degree of visibility of the target.

(d) Errors due to ranging and climatic conditions.

(e) Accuracy of laying and holding by the firer.

2. The flat trajectory of modern ammunition necessarily restricts overhead fire at the closer ranges, if the gun position, friendly troops, and the enemy are approximately in the same horizontal plane; while at long ranges the dispersion of the cone of fire and difficulty in ranging make it necessary to insist on ample precautions being taken to insure safety.

3. Overhead fire, therefore, may normally only be employed under the following conditions:

(a) When the distance to the target has been obtained accurately; that is, by a highly trained range taker, who is able to guarantee the distance within 5 per cent of error.

(b) When the No. 1 at the gun is an expert firer.

(c) When an angle of not less than 30 minutes is formed by the intersection of imaginary lines drawn from the target and friendly troops to the gun, the distance to the target being 1,000 yards or under. If the distance to the target is over 1,000 yards, the angle thus formed should be not less than 60 minutes, if over 1,500 yards not less than 100 minutes, provided always that fire must cease whenever the friendly troops reach a distance of 2,000 yards from the gun, since the position of the lowest shot over this range is uncertain.

The above angles give a sufficient margin of safety at 1,000, 1,500, and 2,000 yards, respectively. At distances within 1,000 yards, between 1,000 and 1,500 yards, and between 1,500 and 2,000 yards, the margin of safety continually increases. In order to obtain these safety angles, it will often be necessary to seek commanding positions for the guns, i. e., rising ground, upper stories of houses, etc.

4. The foregoing instructions may be modified provided accurate and reliable observation is insured. This, however, is a matter for the exercise of judgment and common sense on the part of the machine-gun commander. Too much reliance must not be placed

on the ability of an observer to pick up the cone of fire during an attack. The fire of the attacking troops, the supporting troops and the artillery will probably be such that the machine-gun cone of fire can not be observed correctly.

5. The safety angles may be obtained as follows:

(a) From prismatic field glasses, graticuled for Mark VII ammunition. In this case the distance between the zero line and the 600 yards graticule gives the required angle for 1,000 yards and under; the distance between the zero line and the 1,000 yards graticule will give the angle for distances between 1,000 and 1,500 yards, and the distance between the zero line and the 1,300 yards graticule will give the angle for distances between 1,500 and 2,000 yards.

(b) With the aid of the graticule card as follows:

Hold the card vertically and at the full length of the cord from the eye; the space between the safety lines marked will then give the required angles. (See Pl. XXIV.)

(c) By means of the tangent sight:

Lay the gun on the target with the correct elevation; then move the slide up 300 yards for all ranges up to 2,000 yards without altering the elevation of the gun; and adopt the auxiliary aiming mark thus found. (See Pl. XXV.)

With the tangent sight method, the firer must note carefully the auxiliary aiming mark obtained after raising the slide, and re-lay on this mark. If he is traversing, he must find a second auxiliary aiming mark at the other end of the line to be traversed, and must traverse along an imaginary line joining the two auxiliary aiming marks and parallel to the enemy's position.

The tangent sight method and either graticuled glasses or a graticule card should be used simultaneously, in conjunction with and as a check on each other.

When the heads of the friendly troops become visible to the firer over the sights, he should not cease fire, but should elevate his gun, taking the *enemy position* as his auxiliary aiming mark. This will cause the cone of fire to search ground in rear of the enemy's position, which may be occupied by his supports and reserves.

### 28.<sup>1</sup> *Indirect fire.*

1. On occasions indirect fire may be used. This form of fire is rendered possible by the Mark IV tripod of the machine gun. Guns not fired from a fixed platform must *never* be used for indirect fire.

---

<sup>1</sup> NOTE.—This section does not deal with *overhead* indirect fire or with searching reverse slopes, for which see pars. 30 and 31, respectively.

2. Indirect fire may be of great value in annoying the enemy and affecting his morale, but, except under unusually favorable conditions, can not be expected to inflict serious loss.

The main disadvantages of indirect fire are that it requires, in most cases, a great deal of preparation and accuracy in calculation. Unless officers possess experience, it may sometimes be employed under conditions where direct fire is not only possible but necessary. Under certain conditions it may be positively dangerous to our own troops.

3. As the target is invisible, the problems to be solved are—

- How to lay the gun, both to obtain and to put on elevation and direction; and

How to maintain the laying.

The methods of solving these problems are given in skeleton form in the following table. The actual details of each of the methods are given in the subsequent paragraphs.

*Indirect fire table.*

Direction.	See par.	Elevation.	See par.
Obtained by—			
Posts, direct.....	8	Graticules.....	4
Map and compass.....	9		
Map, protractor, and reference object.....	10	Contoured map.....	5
Put on gun by—			
Posts and compass.....	11	Elevation dial.....	6
Reference object and direction dial.....	12	Tangent sight.....	7
Maintained by—			
Auxiliary aiming mark.....	15	Auxiliary aiming mark.....	13
Direction dial.....	16	Elevation dial.....	14

#### 4. To obtain elevation by means of graticules.

By means of graticules cut across the focal plane of a pair of prismatic field glasses, or by graticules printed on a card with a string for a base, indirect fire can be as quickly applied as ordinary direct fire. These graticules are similar to an inverted backsight and represent the angles of elevation for the gun. The topmost graticule represents zero, and the lines below represent every 100 yards upwards, from 200 yards.

The procedure is as follows:

- (i) Obtain the range to the target.
- (ii) Select an auxiliary aiming mark visible to the firer and directly above the target.
- (iii) Move to a position whence the target and the auxiliary aiming mark already chosen can be observed; look at the target in such a way that the graticule, representing the range to the target, falls

across the target; then see which graticule falls across this aiming mark. (See Pl. XXVI.)

The range corresponding to this graticule is the tangent elevation at which to open fire, using the aiming mark already chosen to lay on. By this means accuracy may be obtained from a gun which is invisible to the enemy. It is important to get an aiming mark vertically above the target, making any necessary allowance for wind. This method becomes inaccurate when the eye of the observer using the graticuled glasses is much below or above the gun.

If it is found necessary to increase or decrease the elevation after fire has been opened, the following method must be employed since the position of the slide does not indicate the range to the target. The range on the sights is the range for the aiming mark and not the actual range to the target, e. g., the sights may show 500 yards when the target is 1,200 yards away. If in this case the cone of fire is observed to fall 100 yards short of the target, the necessary correction will not be obtained by moving the slide of the tangent sight up to 600 yards. It will be necessary to move the slide up for the same distance as from 1,200 yards to 1,300 yards. In moving the slide up for all ranges below 1,500 yards, as many clicks can be heard on the ratchet of the tangent sight as there are hundreds of yards in the range, e. g., between 1,000 and 1,100 yards there are 10 clicks, between 1,100 and 1,200 yards 11 clicks, and so on. In the present example, therefore, it will be necessary to move the slide up for 12 clicks. If the cone of fire were falling 50 yards short, it would be necessary to move the slide up for 6 clicks.

This method of indirect fire must not be employed when firing over the heads of our own troops.

5. *To obtain elevation by means of a contoured map.*

Having noted on the map the exact positions of gun and target, measure the distance between them. From Table I, Appendix A, obtain the corresponding angle of tangent elevation.

From the map note the contours on which the gun and target lie and by subtraction obtain the difference in height between them. By means of the angle of sight formula,<sup>1</sup> knowing the range and the

<sup>1</sup> NOTE.—The "angle of sight" can be calculated by means of the following approximate formula:

$$\frac{VI}{HE} \times 3400 = \text{angle of sight in minutes.}$$

Where VI and HE are in the same denomination.

To convert yards to meters deduct one-tenth.

To convert meters to yards add one-tenth.

From tables in Appendix A the quadrant angle can be obtained directly without working out the angle of sight.



difference in height between gun and target, work out the angle of sight. If the angle of sight is found to be positive, add it to the angle of tangent elevation to obtain the angle of quadrant elevation necessary to put on the gun; if, on the other hand, the angle of sight is found to be negative, subtract it.

6. *To put on elevation by means of the elevation dial.*

To place the required quadrant elevation on the gun—

(a) Level the gun by the spirit level No. 1 taking the holding pressure.

(b) Slip the dial round till zero is under the pointer without disturbing the bubble.

(c) Clamp the dial to, but without disturbing the elevating wheel.

(d) Turn the elevating wheel till the required angle is obtained. One revolution of the elevating wheel produces  $4^{\circ}$  of elevation or depression on the gun. To obtain an angle of elevation of  $8^{\circ}$  the elevating wheel would have to be revolved twice. The elevation dial is accordingly graduated to  $4^{\circ}$ , showing subdivisions of five minutes, which are easily capable of subdivision by eye.

(e) If an obstruction exists between gun and target, make sure before firing that the shots will clear it. (See par. 17.)

7. *To put on elevation by means of the tangent sight.*

This method entails the use of an auxiliary aiming mark which must be at least 100 yards distant from the gun.

To put elevation on the gun by means of the tangent sight, convert the angle of quadrant elevation (see par. 5 above) into a range by reference to Table I, Appendix A. Then level the gun by the spirit level, No. 1 taking the holding pressure.

Any of the four following cases may occur:

(a) Quadrant elevation is positive and a suitable natural auxiliary aiming mark can be seen or an artificial one put out.

(b) Quadrant elevation is negative and a suitable natural auxiliary aiming mark can be seen or an artificial one put out.

(c) Quadrant elevation is positive, but there is no suitable natural auxiliary aiming mark, nor can an artificial one be placed in position.

(d) Quadrant elevation is negative, but there is no suitable natural auxiliary aiming mark, nor can an artificial one be placed in position.

Cases (c) and (d) may occur when the ground slopes down steeply in front of the gun.

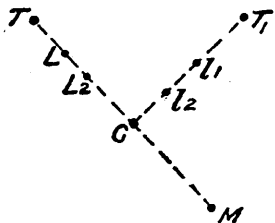
*Case (a).*—With sights at zero, look along the sights and select a natural aiming mark or place one out and lay on it. Run the tangent sight up to the range found above and relay on the auxiliary aiming mark.

*Case (b).*—Run the tangent sight up to the range found above (disregarding the sign), maintaining the holding. Select a suitable natural aiming mark or place one out and lay on it. Run the sights down to zero and relay on the auxiliary aiming mark.

*Case (c).*—Run the tangent sight up till some suitable natural or artificial auxiliary aiming mark is visible and lay on it. Note the range on the tangent sight and convert into an angle by means of the table given in Appendix A. Add to this angle the angle of quadrant elevation found as in (par. 5). Convert the answer into a range by means of the table given in Appendix A. Run the sights up to this range and relay.

*Case (d).*—Run the tangent sight up till some suitable natural or artificial auxiliary aiming mark is visible and lay on it. Note the range on the tangent sight and convert into an angle by means of the table given in Appendix A. Subtract from this angle the angle of quadrant elevation found as in par. 5. Convert the answer into

Fig. 1.



a range by means of the table given in Appendix A. Run the sights down to this range and relay.

#### 8. To obtain direction by posts, direct.

By day, an observer selects the gun position and also the target he wishes to engage. He places a stick (*L*) (see fig. 1) in the ground in rough alignment between the target and gun position. He then crawls back and, if necessary, places a second stick (*L*<sub>2</sub>) in exact alignment with his first stick (*L*) and the target, continuing the process until his last stick is visible from the gun position (*G*). If it is probable that more than one target is to be engaged, other sticks (*l*<sub>1</sub>, *l*<sub>2</sub>) can be placed between the stick (*G*) and the different targets (*T*, *T*<sub>1</sub>). To do this an assistant is required to place the sticks in position while the observer dresses them from *G*. It is necessary to place the sticks vertically in the ground, and the stick (*G*) should not be more than 6 inches above the ground to avoid being knocked over by the crosshead of the tripod when it is placed over it.

Should it be found impossible to place the stick (L) in position owing to the proximity of the enemy, the stick (G) should first be placed in position, and a second stick (M) placed in rear of it and in alignment with (G) and the target.

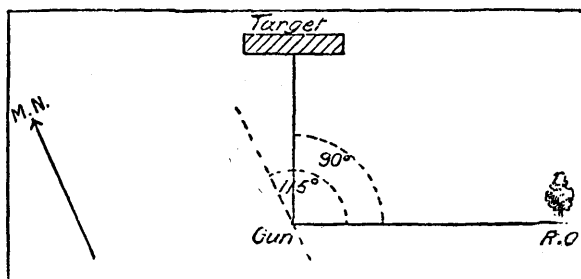
Under cover of darkness the position of (L) can be easily ascertained by an observer at (M) directing an assistant to place a stick in alignment with (M) and (G).

9. *To obtain direction by map and compass.*

To direct fire onto a target invisible to the guns, a map having a scale of not less than 1/20,000 must be used. The exact position of the guns must be marked also. This can be done by resection. (See Chapter XIV, Manual of Map Reading and Field Sketching.)

The magnetic bearing of the target from the gun position must be worked out on the map. If the target to be engaged is a linear one,

Fig. 2.



the magnetic bearings of its limits must be worked out in the same way.

10. *To obtain direction by map, protractor and reference object.*

The exact position of the gun must be marked on the map as directed in paragraph 9 above. If possible, a reference object should be selected, which is marked on the map and visible from the gun position. If the only suitable reference object visible from the gun position is *not* marked on the map, its magnetic bearing should be taken from the gun position, and a line showing its direction drawn through the gun position on the map.

On the map by means of a protractor measure the angle included between lines joining the target and the gun, and the reference object and the gun. (See fig. 2.) If the target to be engaged is a linear one, measure the angles included between lines joining its limits to the gun and the target to the gun,

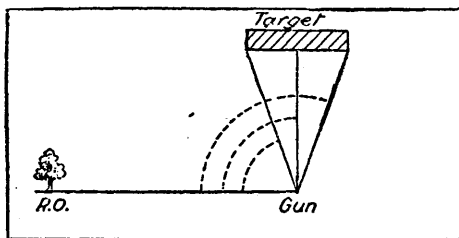
11. *To lay for direction by means of a post and compass.*

To lay out an aiming post, drive in a stick (not more than 6 inches high) at the gun position, and place a compass on top. Rotate the compass till the dial indicates the required magnetic bearing found as directed in paragraph 9. Dress a post on this bearing, using the hair line on the compass glass. Replace the gun and tripod on the first stick and lay on the post put out.

12. *To lay for direction by means of reference object and direction dial.*

The gun is laid on any convenient part of the reference object with the sights set for any convenient range; it need not be leveled. The elevation required to hit the target should not be placed on the gun till the latter is directed on the target. The direction dial should now be set to read zero (or the reading noted if the dial can not be rotated). The gun is then swung right or left through the angle found as directed in paragraph 10, according as the reference

Fig. 3.



object is to the left or right of the target. The gun can be directed to either end of a linear target simply by swinging through the angles found as directed in paragraph 10. (See fig. 3.)

13. *To maintain elevation by means of an auxiliary aiming mark and the tangent sight.*

Once the gun has been laid the sights only may be adjusted so as to bring a line of sight onto any suitable natural or artificial auxiliary aiming mark, e. g., a night firing-box, white or luminous stone, chimney, post, etc. The range shown on the tangent sight after such adjustment will have no connection with the quadrant elevation on the gun, unless the elevation has been put on by the method given in paragraph 7, and the same auxiliary aiming mark is used to maintain it.

The distance between the gun and the auxiliary aiming mark is immaterial when *maintaining* elevation, and in this respect differs from the minimum distance laid down in paragraph 7 when *putting on* elevation.

14. *To maintain elevation by the elevation dial.*

Between bursts of fire the firer should make sure that the pointer continues to show the same quadrant elevation on the dial as was originally put on the gun. If this method is to be reliable, it is essential that the legs of the tripod should not sink unevenly into the ground; the tripod must, therefore, be placed on a firm foundation.

It is desirable, where possible, to use an auxiliary aiming mark in addition, but if this is not possible the spirit level should be placed on the gun at frequent intervals, and the procedure laid down in paragraph 6 for putting on elevation repeated. It should be noted that unless the socket is absolutely upright the quadrant elevation may vary considerably if the gun is traversed through a wide arc, though the reading of the elevation dial will not alter.

15. *To maintain direction by means of an auxiliary aiming mark.* (See par. 13 above.)

16. *To maintain direction by means of the direction dial.*

The gun having been laid for direction, the reading of the direction dial is noted. Direction can be maintained during firing by insuring that the pointer is set accurately to this reading.

17. In all cases where the target is invisible, owing to the presence of an obstacle, steps must be taken before firing to insure that the shots will clear the obstacle. The procedure is as follows:

(a) After the gun has been given the quadrant elevation necessary to hit the target, the tangent sight will be adjusted for the range to the top of the obstacle. If on looking along the sights the obstacle is not visible, the shots will clear. If, however, the obstacle is visible, the shots will not clear, and the gun must be moved farther back.

(b) If the range to the obstacle is under 100 yards, the method given above will not apply, and the No. 1 must look through the barrel, either directly or by using the mirror reflector.

(c) Should the obstacle be invisible from the gun position, recourse must be had to the formula given in section 30, paragraph 4 (l). The clearance required will be one-half of the height of the 90 per cent cone at the range of the obstacle. In using the formula given in section 30, paragraph 4 (l), for "our own troops" read "the obstacle" throughout.

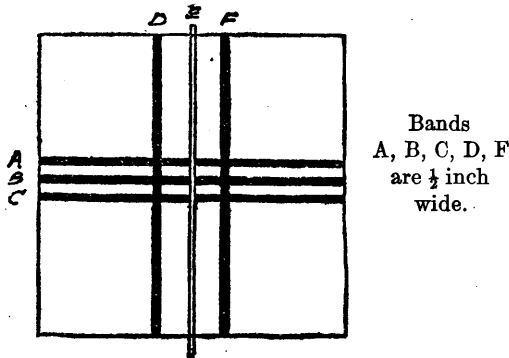
29. *Night firing.*

1. If the gun position is not exposed to the enemy's fire or to direct observation, the gun can be mounted and laid by day and left until night.

Some kind of auxiliary aiming mark must be in position in front of the gun for the purpose of maintaining elevation and direction after nightfall. (See sec. 28.)

This auxiliary aiming mark can be a transparent screen secured to the open side of a box containing some form of illuminant. (See fig. 1.) The screen is marked with lines to permit of searching and traversing within definite limits. The horizontal lines are 1 inch apart, which will give a difference in angle of 10 minutes from the center line if the screen is placed 10 yards from the gun. The amount that 10 minutes represents in range can be readily ascertained from the tables showing the angles of elevation for the gun. (Appendix A, Table 1.) The vertical lines are  $2\frac{1}{2}$  inches apart, which will give a deflection of about 2 feet per 100 yards of range when the screen is placed 10 yards from the gun.

Fig. 1.



2. When the gun position is exposed, or the gun is required elsewhere during the day, it will sometimes be possible for arrangements to be made by day so that the gun and tripod can be brought up under cover of darkness and placed in position to open fire when required. (See sec. 28.)

The direction and elevation dials should be employed; and a luminous reference object should be laid out in any convenient position, where it is invisible to the enemy, for obtaining the direction to any target, correct elevation being put on by the elevation dial.

As the rear leg of the tripod may sink during firing, elevation can not be maintained by means of the elevation dial, which is a component part of the mounting. One or more luminous auxiliary

aiming marks should therefore be laid out by the method given in section 28, paragraph 8.

### 30. *Indirect overhead fire.*

1. In trench warfare, where the positions of our own and the enemy's units are clearly marked, indirect fire over the heads of our own troops may often be safely employed.

2. The best results will be secured when observation of the strike of the bullets can be obtained. The element of chance, due to errors in ranging, climatic conditions, errors as to the exact position of the gun, etc., will thus be removed.

3. Fire may be directed on the hostile support or reserve lines, communication trenches, cooking places, ration parties, reverse slopes of hills, roads, etc. When observation is not possible, the most that can be done is to sweep an area of ground, in which is included the target it is desired to engage. (See sec. 31.)

4. To insure the safety of our own troops the following rules must at all times be strictly adhered to:

(a) The guns must never be more than 2,000 yards distant from bodies of our own troops, over whom they are firing.

(b) When the guns are 1,000 yards or under from our own troops, the range at which they are fired must be such as to insure the center of the cone of fire passing at least 20 yards over their heads. (See trajectory table, Appendix A.) When the guns are between 1,000 yards and 1,500 yards from our own troops this height must be at least 40 yards; between 1,500 and 2,000 yards it must be at least 80 yards.

(c) When, the gun, friendly troops, and target are all on the same plane (not necessarily the same *horizontal* plane), rules (a) and (b) give the following results:

(i) No target may be engaged at a range of less than 1,500 yards.

(ii) Range to target (in yards):	Limits of safety zone for friendly troops (in yards).
1,500 .....	700 to 1,000 from gun.
1,600 .....	500 to 1,000 from gun.
1,700 .....	500 to 1,000 from gun.
1,800 .....	400 to 1,200 from gun.
1,900 .....	400 to 1,500 from gun.
2,000 .....	300 to 1,500 from gun.
2,100 .....	300 to 1,500 from gun.
2,200 .....	300 to 1,500 from gun.
2,300 .....	200 to 1,800 from gun.
2,400 and over .....	200 to 2,000 from gun.

(d) Climatic conditions must be carefully studied (see Musketry Regulations, sec. 29).

(e) The laying must be checked frequently, both for direction and elevation, upon the auxiliary aiming mark.

(f) The necessity for good holding must be impressed on the firer.

(g) As a slight sinking of the tripod during firing may seriously affect the safety of our own troops, owing to the altered angle of elevation, every precaution must be taken to prevent this happening. The legs of the tripod should be firmly imbedded in the ground, and provision made to prevent them moving from their original position, but the use of an auxiliary aiming mark largely minimizes the effect of slight movements of the tripod.

(h) When "traversing" or "searching" is used, provision must be made by means of wooden battens, etc., to fix safe limits beyond which the gun can not be moved.

(i) A worn barrel should not be used, and the barrel should be cleaned after every 1,000 rounds continuous fire.

(j) All calculations must be carefully checked by an officer before fire is opened.

(k) Troops over whom fire is to be opened must be cautioned, and a certificate to this effect signed by the machine gun company commander.

(l) In order to find the clearance, i. e., the height from the ground to the center of the cone at any point in the line of fire, the following is the simplest and most accurate method, which should be used:

- (i) Let gun contour..... =A yards.  
 Let own troops contour..... =B yards.  
 Let center of cone above or below horizontal  
 plane through gun position when passing over  
 own troops' heads ..... =C yards.

Then clearance (yards) =  $A - B$  or  $C$ .

C must be added or subtracted according as the trajectory to our own troops position is above or below the horizontal plane through the gun position.

(ii) From the sketch the clearance is XZ.

Then  $A - B = ZY$  and XY is the height of trajectory either above or below the horizontal plane through the gun position.

Obviously clearance =  $XZ = ZY$  or  $XY = A - B$  or  $C$ .

(iii) In order to find C, either Table 2A or Table 2B must be used according as to whether the quadrant angle on the gun is positive

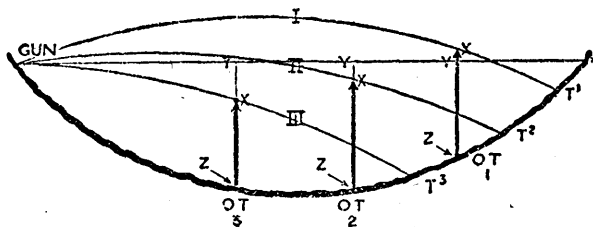


or negative. On these tables, the words "positive" and "negative" are printed. If the trajectory height found is positive, C must be added to A-B; if negative, it must be subtracted from A-B.

(iv) If the quadrant angle on the gun is positive, the range corresponding must be found from Table 1 in order to use Table 2(A). If the quadrant angle is negative it will be used directly in Table 2(B) without conversion.

(v) The following three examples illustrate the method and deal with three typical cases. (See sketch above.)

CASE I.—Quadrant angle is positive and sufficiently large to throw the center of cone above the horizontal plane when passing over own troops' heads.



*Example.* Gun contour (A)=70 yards.

Own troops contour (B)=20 yards.

Q.E.=+86 minutes. Range corresponding=1,200 yards.

Assumed range to own troops 900 yards.

From Table 2(A) trajectory height for 1,200 yards at 900 yards =9 yards (positive)=C.

Clearance=A-B+C.

=70-20+9=59 yards.

Clearance required=20 yards. It is safe to fire.

CASE II.—Quadrant angle is positive but small so that the center of cone is below the horizontal plane when passing over own troops' heads.

*Example.* A and B as above.

Q.E. =+35 minutes. Range corresponding=700 yards.

Assumed range to own troops 900 yards.

From Table 2 (A) trajectory height for 700 yards at 900 yards=4.5 yards (negative)=C.

Clearance=A-B-C.

=70-20-5 (say)=45 yards.

Clearance required=20 yards. It is safe to fire.

CASE III.—Quadrant angle is negative.

*Example.* A and B as above.

Q. E. = -75 minutes.

Assumed range to own troops 900 yards.

From Table 2B trajectory height for -75 minutes at 900 yards = 33.2 yards (negative) = C.

Clearance = A - B - C.

= 70 - 20 - 33 (say) = 17 yards.

Clearance required = 20 yards. It is not safe to fire.

(vi) In Appendix B is given a copy of the "indirect overhead fire" sheet which should be used on service. Certain specimen examples have been filled in on it, for the purpose of bringing out various points.

5. Elevation and direction may be obtained, put on the gun, and maintained by any of the methods described in section 28. The dials are particularly suitable for this type of fire.

### 31. *Searching reverse slopes.*

1. It may sometimes be desired to search the reverse slope of a hill occupied by the enemy, where he is under shelter from short-range fire.

2. Reverse slopes are often chosen by the enemy as suitable areas where troops may be disposed preparatory to attack, or may maneuver free from observation. It is therefore necessary to know how such ground may be brought, most effectively, under machine-gun fire. Table 7 enables the machine-gun officer to search the reverse slope of a hill, and is constructed on the following basis:

3. If a gun is placed at such a distance from the crest that the cone, just passing over it, will fall at a steeper angle than the slope of the ground on the other side of the hill, then fire effect will be brought to bear on the reverse slope. No endeavor has been made to fit the trajectory exactly to the reverse slope, as the difficulties and variables in the problem are so many, that small errors would upset the results. Traversing and searching should be employed, for the same reasons as govern all forms of indirect fire.

4. *Table 7.*—This table is so constructed that when the gun is placed as required by its use, and fire suitably directed at the reverse slope, the bullets will fall on it at an angle of somewhere between 100 and 200 minutes to the slope itself.

The table is divided into two parts, "Gun above crest" and "Gun below crest."

The table is used as follows:

(a) On the map, draw a line from the crest, which will be the probable line of fire.

(b) From the map, determine the drop *in yards* in 100 yards, measured from the crest down the slope.

(c) Making use of the two top horizontal columns, note the distance to measure back, which will vary according as the spot thus found is above or below the crest. (See center column.)

(d) From map note the difference in height between this spot and the crest, above or below as the case may be. Run down the center column till this height is found.

(e) Then look along horizontally, when the final range from the crest will be found in the vertical column under the drop in yards found in (b).

(f) Place the gun at this point, and lay on the crest by any suitable means.

NOTE.—If it is found that the gun position is on the same level as the crest two answers will be given, i. e., one in portion of "Gun above crest," one in portion "Gun below crest," both opposite the zero mark. Select the most suitable.

---

## CHAPTER VI.

### MACHINE GUNS IN BATTLE.

#### 32. *Introductory.*

1. The general principles laid down in Infantry Training, Chapter XV, for the employment of machine guns in battle remain unaltered by the introduction of the machine-gun company organization and the substitution of Lewis gun detachments for machine-gun sections in battalions. But the new organization and the increase in the number of machine guns with infantry units have rendered necessary certain modifications in detail which are discussed in the present chapter. A certain amount of repetition and rearrangement of matter that is already dealt with in Infantry Training has been found necessary in order to avoid too frequent reference to paragraphs or sentences in that manual.

2. The special characteristics of Lewis guns and the manner in which these characteristics affect their employment must be studied by machine-gun officers, as they have to cooperate closely with Lewis guns. These characteristics, therefore, are discussed in

sections 33 and 34.<sup>1</sup> Detailed instructions for Lewis guns are given in Lewis Gun Training.<sup>2</sup>

3. The special principles which govern the employment of machine guns in the phase of operations known as trench warfare are dealt with in Notes for Infantry Officers on Trench Warfare.

4. It must be remembered that in Infantry Training a machine-gun section means two guns, whereas under the present organization it means two subsections each of two guns, or four in all.

### 33. Characteristics of machine guns and Lewis guns compared.

1. The principal characteristic of the machine gun is its ability to produce *rapid and sustained fire*. Provided water and ammunition are available, a machine gun is capable of keeping up a rapid fire for a very considerable period.

On the other hand, the Lewis gun, though capable of extremely rapid fire, is incapable of sustaining this fire for long. This necessitates, therefore, the use of short bursts of fire as the normal practice.

Its inability to sustain fire is primarily due to the fact that a water jacket is not provided (in order to economize weight) and the gun consequently becomes hot very quickly. Further, owing to their lightness, the working parts will not stand constant vibration to the same extent as those of the machine gun.

2. A further difference between the two weapons is in the type of mounting used. The machine gun is provided with a heavy tripod which enables the gun to be used for overhead and indirect fire. This mounting also allows of the gun being laid on a fixed point, and fired at any time, by day or night, without further preparation. By this means it is possible to form "bands of fire" through which any enemy attempting to pass must suffer heavy loss.

The Lewis gun is fired from the shoulder, a light bipod providing a support for the barrel; there is no traversing or elevating gear; and aim is taken and altered as when using a rifle, the conditions are, therefore, not suitable for overhead or indirect fire, nor for creating "bands of fire."

3. The machine gun, owing to its weight, and that of its mounting, is less mobile than the Lewis gun. The latter being specially provided with a light bipod to increase its mobility, can be carried like a rifle, and fired with very little preliminary preparation, so that

<sup>1</sup> Infantry battalions are provided with Lewis guns organized in Lewis gun detachments of 1 noncommissioned officer and 12 men each, with 2 Lewis guns.

<sup>2</sup> To be issued shortly.

after movement its fire can be brought to bear on any object much more rapidly than that of a machine gun.

### 34. *The employment of Lewis guns.*

1. Owing to its greater mobility a much greater liberty of action can be allowed to this weapon than to the machine gun. It must, however, be clearly understood that the Lewis gun can not take the place of the machine gun. It is a supplement to and not a substitute for the latter type of weapon.

2. It is adapted for even closer cooperation with infantry than the machine gun, as the Lewis gunner can move and appear to the enemy as an ordinary rifleman. Its distribution as a battalion and company weapon provides a mobile reserve of fire available for the smallest unit commander wherever an infantry soldier can go.

3. It is specially adapted for a concentrated enfilade fire on a definite line such as a hedge or wall, or to cover a road or defile where it is not possible to deploy a number of rifles, and for places where it is difficult or impossible to bring up a machine gun unobserved. When wider fronts have to be swept with fire or heavier fire is required at longer ranges machine guns can be more usefully employed.

4. Although the expenditure of ammunition is not so great as with machine guns, the difficulty of getting ammunition up to the more exposed positions to which Lewis guns can go will be much greater. It is important, therefore, to withhold fire as long as possible and to use the power of the gun to develop unexpected bursts of fire against favorable targets.

### 35. *The tactical handling of infantry machine guns.*

1. The tactical principles laid down in Infantry Training, sections 160, 161, and 162, apply generally, but the organization and distribution of the machine guns with a brigade there discussed need modification to suit the new organization and distribution of machine guns.

2. The introduction of the machine-gun company organization, while facilitating the collective employment of machine guns, does not mean that they should always be so employed. It may sometimes be advisable to detach machine guns under the orders of battalion commanders and this should be done if the tactical situation requires it. (See sec. 36 (2) (3).). In this case the battalion commander concerned should clearly understand the reasons why the guns are attached to him. Definite instructions should be given

by the battalion commander to the machine-gun officer as to what is required of him, but the latter should be allowed as much freedom as possible in the execution of his task.

3. *Command and control.*—The various tasks which the machine-gun company has to carry out demand the most careful preparation and organization on the part of the company commander.

He must insure that all section commanders fully understand the part they have to play, and he must be always on the watch to regain control, at the earliest possible moment, of any guns temporarily detached, in order to provide a reserve for his brigade commander.

During action the machine-gun company commander will keep in the closest possible touch with the brigade commander, and it is important that section officers should keep in close touch with the commanders of units to which they may be attached and under whose command they come. Machine-gun officers must carefully observe this principle in order to avoid dual control and consequent misunderstanding.

It is unsafe to rely on telephones, especially in open fighting. Steps must, therefore, be taken to maintain communication by visual signaling and by orderlies.

4. *Cooperation.*—Cooperation is an essential feature in machine-gun tactics, both between the machine guns and other arms and between the guns themselves.

Grouping machine guns into companies by centralizing control facilitates the execution of a comprehensive scheme of machine-gun cooperation in accordance with the needs of the tactical situation. When this is to be effected the machine-gun company commander must be thoroughly conversant with the situation. He should take every step to insure cooperation, not only between the guns of his company, but between his company and machine guns on the flanks.

5. *Concealment.*—

(a) *During movement.*—To insure concealment when on the move machine gunners should try to disguise their identity as such by adopting the formation of the neighboring troops. This, and any other means of escaping detection, should be constantly practised.

When machine guns are moving, they should watch and avoid areas that are being swept by shell fire.

(b) *When in position:*

(i) As few men as possible should be near the gun. It will usually be found that two men are quite sufficient.

(ii) When time, implements, etc., are available, guns should be dug in, but, unless it is possible to construct a really satisfactory em-

placement, it is better to seek cover from view. A hastily made emplacement will merely serve to draw the attention of the enemy.

(iii) Masks and gloves will often facilitate concealment, especially when facing strong sunlight.

Every effort must be made to prevent machine guns being located by artillery. If, however, machine guns are shelled, their action will largely depend on the tactical situation. They may make a change in position of about 50 yards or they may temporarily cease fire, the guns and detachment getting under cover; the latter will often deceive the enemy into thinking that they have been destroyed and enable the guns to obtain a good target later. A careful distribution of the gun numbers will minimize casualties.

### 36. *Machine guns in the attack.*

1. In order to obtain the best results, the machine-gun company commander must be thoroughly acquainted with the plan of operations and must make a careful reconnaissance of the ground.

By use of maps and study of the ground through a telescope from positions in rear or on the flanks, he should endeavor to make himself familiar with the nature of the ground, the correct use of which may prove of decisive value. (See Infantry Training, sec. 161.)

Having made his reconnaissance, and having received instructions from the brigade commander (Infantry Training, sec. 160 (13)), the machine-gun company commander will give definite orders to his section officers.

2. *Distribution of machine guns in the attack.*—The machine-gun company commander may divide the guns under his command into groups, some to go forward with the Infantry, some to cover their advance, others as a reserve.

3. The machine guns that go forward with the attacking Infantry will be placed under the control of the Infantry commander to whom they are attached. (See Infantry Training, sec. 160 (13).)

The rôle of these guns will be to—

- (a) Assist the Infantry in obtaining superiority of fire.
- (b) Make good the positions won.
- (c) Pursue the enemy with fire.
- (d) Cover reorganization of the Infantry.
- (e) Repel counterattack.
- (f) Cover retirement in the event of the attack proving unsuccessful.

The number of guns to be sent with the Infantry will be governed by two factors, viz, the length of front and the nature of the ground.

The *time* of their advance will be determined by the nature of the ground and progress of the Infantry. The progress of the Infantry must be carefully watched so that the guns may be brought forward at the earliest possible moment. They should very rarely advance with the leading line of Infantry. This is the duty of the Lewis guns, the fire of which should suffice to hold the position won until it can finally be consolidated by the machine guns.

4. The guns detailed to cover the advance of the Infantry will normally be under the control of the machine-gun company commander, who acts under the instructions of the brigade commander. The rôle of these guns will be to provide covering fire for the Infantry up to the last possible moment in the following ways:

(a) By fire from the flanks or through gaps in the line.

(b) By overhead fire.

(c) By indirect fire.

Great care must be exercised in (b) and (c) in order to avoid endangering our own troops.

Orders to the machine guns detailed for this task may, if necessary, include general instructions to govern their action, after the task has been completed, pending receipt of further orders from the machine-gun company commander. It must, however, be remembered that it is usually dangerous to prescribe to a subordinate at a distance anything that he should be better able to decide on the spot, with a fuller knowledge of local conditions, for any attempt to do so may cramp his initiative in dealing with unforeseen developments. (See F.R.S., Part I, sec. 12, par. 2.)

5. Guns kept as a reserve will be under the control of the machine-gun company commander, acting under the instructions of the brigade commander. Owing to their characteristics, machine guns are valuable as a reserve of fire power, and when kept in reserve in the hands of the brigade commander may prove of the utmost value at the critical moment. It must be remembered, however, that a great development of fire power is most useful in the opening stages of an attack, to cover the advance of the infantry, and it is a mistake to keep guns in reserve if they can be usefully employed in supporting the advance. These guns may be used for long range searching fire on ground behind the enemy's line, which is likely to hold supports or reserves, but must be available to move forward at once, when required.

6. The great fire power of machine guns relative to the space they occupy, the rapidity with which they may be brought into or out of action and the ease with which they can change the direction



of their fire render them especially suitable for the protection of threatened flanks and for filling gaps which may appear laterally or in depth. Any of the guns mentioned in the previous paragraphs may at times be employed in this manner.

7. During an attack it may be advisable to continue to hold certain tactical points, which have been captured, until the attacking troops have made good their next objective. The characteristics of machine guns fit them for this duty; their use will avoid diminishing the strength and dash of the attacking infantry.

8. *Limbers and ammunition reserve.*—Gun limbers will generally remain under the orders of section or subsection officers, but ammunition limbers would, as a rule, be placed under the officer in charge of the brigade ammunition reserve (Infantry Training, sec. 166 (2)), or under a machine-gun officer, who should keep thoroughly in touch with the progress of the machine guns so that he may be able to keep the wagons as close up as possible.

When machine guns are attached to battalions, a proportion of ammunition limbers will accompany them if required.

It must be remembered that ammunition limbers are far less mobile than gun limbers.

### 37. *Machine guns in the defense.*

1. When it has been decided to consolidate a position for defense a reconnaissance should be carried out, the machine guns being generally allotted on the following principles.

2. Some guns should be posted as soon as possible in accordance with the nature of the ground to form a complete belt of flanking machine-gun fire along the front of the position. Important concealed approaches and folds in the ground should also be covered by machine guns.

Cooperation must be arranged with the Lewis guns of battalions, which can cover the less important approaches or small depressions or hollows which the machine guns can not sweep.

3. A proportion of machine guns should be kept in reserve. When the ground is suitable, these may be used for indirect overhead fire if the results are likely to justify the expenditure of ammunition, and the readiness of the guns to take up other tasks is not impaired. It will often be found advisable to prepare machine-gun emplacements at important tactical points in rear of the front line and to detail guns for their occupation, if necessary. Preparation in this respect will facilitate a rapid readjustment of the line at any point.

4. Secondary positions and lines of retirement must be reconnoitered, and steps must be taken to insure that the detachments are familiar with them. In case of a withdrawal becoming necessary, machine guns in supporting positions will cover the retirement of the Infantry and guns in the front line. When the latter have occupied their secondary positions, they, in their turn, will cover the movement of the guns originally in support.

5. Arrangements for firing at night should be made. The day and night gun positions will probably be different; the change from the one to the other should be made just after dark and just before dawn.

6. Communication must carefully be arranged throughout machine-gun sections. Machine-gun officers must keep in touch with battalion commanders and the machine-gun company commander. (See sec. 35, par. 3.)

7. The following points should also be noted:

(a) The position of the ammunition limber should be determined and the arrangements for ammunition supply made known to all concerned.

(b) Range cards should be made for each gun.

8. The variations that arise during the protracted defense of a position are dealt with in Notes for Infantry Officers on Trench Warfare.

### 38. *Machine guns with an advanced guard.*

1. The functions of an advanced guard make it necessary that great fire power should be available when required. A large proportion of machine guns should therefore be allotted to advanced guards.

These machine guns should move well forward in the column, so that they may be able to get quickly into action.

2. The principal duties of machine guns with the advanced guard are to—

(a) Assist in driving back enemy forces by rapid production of great fire power at any required point;

(b) Assist in holding any position gained until the arrival of the Infantry;

(c) Cover the deployment of the main body by holding the enemy on a wide front.

3. The characteristics of machine guns render them as a rule more suitable for employment with the main guard than with the van-

guard, but the size of the vanguard may necessitate machine guns being attached to it.

### 39. *Machine guns with a rear guard.*

1. As rear guards will usually be required to hold positions with the minimum of men, a large proportion of machine guns should be allotted to them.

2. Experience has shown that well-placed machine guns, supported by a few Infantry only, will frequently hold up an advance for long periods.

3. In occupying a rear guard position with machine guns the ordinary principles of defense apply, but the following points should be specially noted:

- (a) As wide a field of fire as possible should be selected.
- (b) Guns must be concealed in the least obvious places.
- (c) Covered lines of retirement must be reconnoitered.
- (d) Gun limbers should be close up to facilitate a hasty retirement.
- (e) Positions in rear must be chosen before the machine guns retire from their forward positions.
- (f) A proportion of the machine guns should occupy the positions in rear before all the machine guns retire from the forward position. Thus the retirement of the last gun can be covered.
- (g) Pack transport is very useful.

### 40. *Village fighting.*

1. As soon as the infantry have made good one edge of a village, machine guns should be brought up in close support. They should then search windows, doorways, roofs, etc., likely to be held by the enemy.

2. Machine guns should be used to command cross streets, etc., so as to guard against attack on the flanks or rear of the infantry. They should also be posted on the edges of the villages to prevent flank attacks, and when possible should be pushed forward well on the flanks, so as to command the exits from the village.

3. During village fighting use may be made of windows, doors, etc., as machine-gun positions. If a good field of fire can not be obtained from existing doors and windows, and time is available, small holes can be made in the outside walls of the upper stories of buildings, enabling a good field of fire to be obtained.

*41. Occupation of various positions.*

1. Machine guns may be hidden in almost any position, but it is advisable to avoid places which are either obvious or easy to recognize, such as cross roads or single objects, or places which can easily be located on the map. It is important that guns should merge into the surroundings, and straight edges or distinct shadows should not be made.

2. Banks of rivers, canals, and railways, ditches, folds in the ground, hedges, palings or walls, also mounds of earth, may be used either to afford a covered line of approach and supply to a gun position or else a gun position itself. When firing over the top of the cover, greater protection is given if hollows are scooped out for the front tripod legs. (Pls. XII to XIV.)

3. Houses may be employed in the following ways:

The gun may be placed in rear, firing through windows or doors in line or past the sides of the house. When firing from a window, door, or hole in the roof, the gun should be placed well back for concealment. (Pl. XVI.) A damp piece of cloth hung in front of the gun helps to conceal the flash. When firing from a cellar, care should be taken not to cause a cloud of dust to rise and give away the position. A means of retirement and alternative emplacements should be arranged. Overhead fire and observation may often be obtained from high buildings.

4. Woods and crops provide cover from view, facilities for communication, and good lines of approach or supply. In neither case should guns be placed too near to the front edge. In woods it will often be possible to construct hasty overhead cover.

5. If a barricade has been constructed across a road, machine guns should not be put on the barricade itself but, if possible, in a concealed position to a flank from which they can sweep the road.

6. Haystacks do not as a rule afford a very satisfactory position, but guns may be placed in a hollow in front, or behind, firing past the side, or else in a hollow on top, firing through the front face of the stack. A machine gun concealed in a field which is covered with cornstalks, manure heaps, or mounds of roots is very hard to locate. (Pl. XV.)

7. Wood stacks, planks, logs of trees, and farm implements may be used to conceal guns; cover from fire can often be obtained by the addition of bricks or sandbags. (Pl. XV.)

8. Trees generally provide better observation posts than machine-gun positions.

42. *Signals.*

In many cases observation will be impossible from the gun position, and it will be necessary for observers to signal results from a flank. The following semaphore code is used in signaling the results of observation of fire:

O = Fire observed *over*.

S = Fire observed *short*.

R = Fire observed to *right* of target.

L = Fire observed to *left* of target.

K = Fire observed *correct* (target or range).

W = Fire unobserved or "Washout."



TABLE 2 (A).—Trajectory table, .303 Vickers gun, Mark VII ammunition.

Range yards.	Point distant from gun in yards.																											
	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800	
0.....	0.4	1.0	1.9	3.2	4.9	7.1	10.0	13.6	18.0	23.4	30.0	38.2	47.6	58.9	72.1	87.5	105	125	149									
100.....	.2	.7	1.5	2.8	4.4	6.5	9.3	12.8	17.2	22.4	28.9	37.0	46.4	57.0	70.7	86.0	104	124	147									
200.....	0	.4	1.1	2.2	3.7	5.7	8.4	11.8	16.0	21.1	27.6	35.5	44.8	55.9	68.9	84.0	102	121	145									
300.....	.3	0	.6	1.6	3.0	4.9	7.5	10.7	14.8	19.8	26.3	34.0	43.1	54.5	67.0	81.6	99.5	119	142									
400.....	.5	.5	0	.9	2.1	3.9	6.3	9.5	13.3	18.3	24.3	32.1	41.4	52.0	64.4	79.6	96.8	117	140									
500.....	.9	.9	.6	0	1.1	2.6	4.9	7.9	11.6	16.3	22.1	29.6	38.5	49.2	61.4	76.6	93.6	113	136									
NEGATIVE																												
600.....	1.2	1.4	1.3	.9	0	1.4	3.5	6.3	9.8	14.4	20.2	27.6	36.1	46.6	59.0	73.6	90.6	110	133									
700.....	1.6	2.0	2.1	1.9	1.2	0	1.9	4.5	7.9	12.2	17.8	25.0	33.3	43.6	55.8	70.1	87.0	106	128									
800.....	2.1	2.7	3.1	3.1	2.6	1.6	0	2.4	5.5	9.6	15.0	21.9	30.0	40.1	52.0	66.1	82.7	102	124									
900.....	2.6	3.5	4.1	4.4	4.2	3.5	2.0	0	2.9	6.7	11.9	18.5	26.4	36.2	48.0	61.7	78.0	96.6	119									
1,000.....	3.2	4.3	5.3	5.8	5.9	5.5	4.4	2.6	0	3.5	8.7	14.7	22.4	31.8	43.2	56.9	72.8	91.1	113									
1,100.....	3.9	5.4	6.6	7.5	7.9	7.8	7.1	5.6	3.3	0	4.5	10.6	17.9	27.0	38.2	51.4	67.0	85.0	106									
1,200.....	4.6	6.5	8.1	9.3	10.2	10.3	10.1	9.0	7.1	4.2	0	5.7	12.6	21.4	32.1	45.0	60.1	78.0	98.9									
1,300.....	5.5	7.8	9.5	11.5	12.7	13.4	13.5	12.8	11.3	8.6	5.1	0	6.5	14.8	25.1	37.5	52.3	69.5	90.0									
1,400.....	6.4	9.2	11.7	13.8	15.5	16.7	17.2	17.0	16.0	13.9	10.6	6.0	0	7.9	17.7	29.6	43.9	60.7	80.8									
1,500.....	7.3	10.7	13.7	16.3	18.7	20.3	21.3	21.7	21.9	19.7	17.0	12.7	7.3	0	9.3	20.7	34.6	50.8	70.4									
1,600.....	8.7	12.7	16.0	19.3	22.0	24.3	26.0	27.0	27.0	26.0	24.0	20.4	15.3	8.7	0	10.9	24.1	39.7	58.6									
1,700.....	10.0	14.3	18.7	22.7	26.0	29.0	31.3	32.7	33.3	33.0	31.7	28.7	24.3	18.3	10.0	0	12.6	27.6	45.9									
1,800.....	11.3	16.7	21.3	26.0	30.3	33.8	36.7	39.0	40.3	40.7	40.0	37.7	34.3	28.7	21.3	12.0	0	14.3	32.0									
1,900.....	13.0	19.0	24.7	30.0	35.0	39.1	43.0	46.0	48.3	49.3	48.0	45.0	40.3	33.7	25.0	14.0	0	16.8										
2,000.....	14.3	21.3	27.7	34.0	39.7	45.0	49.7	53.3	56.7	58.3	59.3	58.7	53.0	47.3	39.3	29.0	16.0	0										
2,100.....	16.3	24.3	31.7	38.7	45.3	51.7	57.0	62.0	65.7	68.7	70.7	69.8	66.7	62.0	54.7	45.7	33.7	18.7	0									
2,200.....	18.3	27.3	35.7	43.7	51.3	58.7	65.0	71.7	77.7	80.7	82.7	83.7	81.7	77.7	71.7	63.3	52.3	38.3	20.7	0								
2,300.....	20.7	30.7	40.0	49.3	58.3	66.7	74.0	81.7	88.3	92.0	96.0	98.0	99.0	98.3	95.7	90.7	83.3	73.7	60.7	44.0	24.0	0						
2,400.....	23.0	34.0	45.0	55.3	65.3	74.7	83.3	91.7	99.0	105	110	114	116	116	115	111	105	96.0	84.3	69.0	50.7	27.3	0					
2,500.....	25.7	38.0	50.0	62.0	73.3	84.0	94.3	104	112	120	126	131	135	136	136	134	129	121	111	97.0	79.7	58.0	31.7	0				
2,600.....	28.7	42.7	56.3	69.3	82.3	94.3	106	117	127	136	144	150	155	158	159	158	155	149	140	127	111	91.0	66.3	35.3	0			
2,700.....	32.3	47.7	62.7	77.7	92.0	106	119	132	143	153	163	171	178	182	185	186	184	180	172	161	147	128	105	75.7	41.7	0		
2,800.....	35.3	52.7	69.7	86.3	102	118	133	147	161	173	184	194	202	209	213	215	215	212	207	197	185	168	146	119	86.0	46.3	0	
L. S.....	.7	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	4.0	4.7	5.3	6.0	6.7	7.3	8.0	8.7	9.3	10.0	13.3	16.7	20.0	25.0	30.0	35.0	41.7		

## NOTES.

The table is divided into two parts, one below the zero line and the other above. That part below the zero line is the ordinary trajectory table; that part above and the words "positive" and "negative" are for use when determining clearance in indirect overhead fire. (See sec. 30, par. 4 (I).)

## PART BELOW ZERO LINE.

1. This table gives at any distance from the gun the height *in yards* of the center of the cone *above* the line of sight.

*Example.*—At a range of 1,900 yards and at a distance of 1,000 yards from the gun the center of the cone is 48.3 yards above the line of sight.

2. To find the height of the lowest shot above the line of sight *subtract* the figure in the line marked L.S. from the height of the trajectory.

101862°—17. (To face page 84.)

*Example.*—At a range of 1,800 yards the lowest shot at 900 yards from the gun is 39 — 3 = 36 yards above the line of sight.

## PART ABOVE ZERO LINE.

1. This table gives at any distance from the gun the height *in yards* of the center of the cone *below* a horizontal plane passing through the gun position. When using this table the range is not the range to the target, but is the quadrant angle on the gun converted to a range by Table 1, column 2.

*Example.*—At a range of 800 yards, and at a distance of 1,200 yards from the gun the center of the cone is 15 yards below the horizontal plane through the gun position.

2. To find the height of the lowest shot below the horizontal plane passing through the gun position *add* the figure in the line L.S. to the height of the trajectory.

*Example.*—At a range of 800 yards, the lowest shot at 1,400 yards from the gun is 30 plus 6 = 36 yards below the horizontal plane through the gun position.

2,000.....	541	One in 6.4	10.0	6.7	16.7	70	130	6.7	10.9
2,100.....	256	One in 5.5	13.3	8.0	18.0	74	140	8.0	13.4
2,200.....	288	One in 4.8	16.7	9.3	19.3	78	150	9.3	16.2
2,300.....	322	One in 4.2	20.0	10.7	20.7	82	160	10.7	18.5
2,400.....	360	One in 3.7	23.0	12.0	22.0	86	170	12.0	23.2
2,500.....	401	One in 3.3	30.0	13.3	23.3	90	180	13.3	27.2
2,600.....	447	One in 2.9	35.0	16.7	25.0	100	190	16.7	34.5
2,700.....	496	One in 2.6	41.7	20.0	26.7	110	200	20.0	42.3
2,800.....	551	One in 2.3	48.3	23.3	28.3	120	210	23.3	52.1
	610								



TABLE 2 (B).—Trajectory table for negative quadrant angles, .303 Vickers gun, Mark VII ammunition.

[illegible]

## NOTES.

1. This table gives at any distance from the gun the height, in yards, of the center shot of the cone below a horizontal plane passing through the gun position.
2. It is for use when determining clearance over our own troops' heads in direct overhead fire. (See sec. 30, par. 4 (1).)
3. The line Q. E. = -5 means that at 1,000 yards, for instance, each addition of 5 minutes to the Q. E. adds 1.4 yards to the height of the trajectory.

*Example.*—Q. E. = -285 minutes; range = 1,400 yards. Trajectory height = 149 plus 2 yards for each 5 minutes added above 250.  
 $= 149 + (\frac{1}{5} \times 2) = 155.$

# MACHINE GUN NOTES NO. 1.

TABLE 3 (A).—The quadrant angle in minutes, knowing range and V. I., .303 Vickers gun, Mark VII ammunition.

V. I. in yards.		Range to target in yards.																									
		500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800	2,900	3,000
1	7			4		4	3	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1
	56	57	60	65	71	79	89	100	114	129	147	166	187	211	236	265	296	330	368	408	454	503	557	616	682	758	844
	91	85	84	96	104	115	127	142	158	177	197	220	245	273	304	338	375	415	461	509	564	622	688	762	842	930	1,020
	125	114	109	108	109	110	120	129	141	154	169	187	207	230	254	282	313	345	382	423	468	516	570	632	708	798	898
	160	143	133	126	120	131	136	143	154	166	181	198	218	239	263	290	321	353	390	430	475	522	577	635	708	798	898
2	194	171	158	141	148	151	158	167	178	192	209	228	249	272	299	329	361	397	437	481	529	583	641	708	798	898	1,000
	228	200	183	172	167	172	181	191	204	220	238	258	278	297	318	342	370	400	435	473	516	562	615	672	748	848	948
	263	229	194	186	183	193	204	216	230	248	267	287	307	327	348	372	399	429	464	503	546	594	647	712	802	902	1,000
	297	258	232	215	207	207	217	227	241	258	278	298	318	338	358	382	409	439	474	513	556	604	657	722	812	912	1,000
	332	286	256	237	224	217	214	215	220	228	238	252	268	287	309	334	362	392	427	465	509	556	608	665	738	838	938
3	366	315	281	258	243	234	229	229	233	240	250	263	278	297	318	342	370	400	435	473	516	562	615	672	748	848	948
	400	344	305	279	262	251	245	244	247	252	261	273	288	306	327	351	378	408	442	480	523	569	621	678	758	858	958
	435	372	330	301	281	268	261	258	260	265	273	284	299	316	336	359	386	416	450	487	530	576	628	684	768	868	968
	469	400	354	323	300	285	276	272	273	277	284	295	309	325	345	368	394	424	457	494	537	582	634	690	778	878	978
	503	429	379	344	319	303	292	287	286	289	296	306	319	335	353	376	402	432	465	501	544	589	646	706	798	898	998
4	538	458	403	366	338	320	307	302	300	302	307	316	329	344	362	385	411	440	472	509	550	596	646	703	798	898	998
	572	486	428	387	358	337	323	317	313	314	319	327	339	354	372	394	419	448	480	516	557	603	652	709	798	898	998
	606	515	452	408	377	354	339	331	327	327	330	338	349	363	381	403	427	456	487	523	564	609	659	715	798	898	998
	641	544	477	429	396	371	354	340	339	342	348	358	373	390	411	436	464	495	530	571	616	665	721	798	898	998	
	675	572	502	451	415	389	370	360	353	351	353	359	369	383	399	420	444	471	502	538	577	622	671	727	798	898	998
5	688	602	526	472	434	406	386	375	366	363	364	370	379	392	408	429	452	479	510	545	584	629	678	733	798	898	998

## NOTES.

1. This table combines the angle of sight with the angle of tangent elevation, thereby producing the quadrant angle directly.
2. It is used as follows: Range=1,900 yards. Target 55 yards above gun. Quadrant elevation=327 minutes.
3. The top line where V. I. = 1 yard is used as follows: Example I. Range=1,900, V. I. = 57 yards. The quadrant elevation for range=1,900 and V. I.=55 is 327 minutes. For each extra yard of V. I. the top line shows that 2 minutes must be *added*. Therefore necessary quadrant angle is 327 plus  $(2 \times 2) = 331$  minutes.

TABLE 3 (B).—The quadrant angle in minutes, knowing range and V. I., .303 Vickers gun, Mark VII ammunition.

V. I. in yards.	Range to target in yards.																		
	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300
1	7	6	5	4	4	3	3	3	3	2	2	2	2	2	2	2	1	1	1
5	-12	-1	10	21	33	45	57	72	88	105	123	144	167	191	218	248	280	314	352
10	-47	-29	-14	0	14	28	42	57	75	92	112	133	157	182	209	239	272	306	345
15	-81	-58	-39	-22	-5	10	26	43	61	80	101	123	147	172	200	230	263	299	338
20	-116	-87	-64	-43	-25	12	29	48	68	88	109	132	156	181	209	239	272	306	345
25	-150	-115	-88	-65	-44	15	34	54	75	96	117	141	166	191	222	255	291	330	372
30	-184	-144	-113	-86	-63	18	39	60	82	104	126	151	176	201	233	268	307	352	403
35	-219	-173	-137	-108	-82	21	43	66	90	114	138	163	188	213	248	287	331	381	438
40	-253	-202	-162	-129	-101	24	48	72	97	122	147	172	197	222	257	297	342	393	450
45	-288	-230	-186	-151	-120	27	53	78	104	130	156	181	206	231	266	306	352	404	462
50	-322	-259	-211	-172	-139	30	58	84	111	138	164	190	215	240	275	315	362	415	474
55	-357	-288	-235	-193	-158	33	63	90	118	146	172	198	223	248	283	323	370	424	484
60	-391	-316	-260	-215	-177	36	68	96	124	152	179	204	229	254	289	329	376	431	492
65	-425	-344	-284	-237	-197	39	73	101	130	158	185	210	235	260	295	335	382	437	500
70	-460	-372	-309	-258	-216	42	78	106	136	164	191	216	241	266	299	339	386	441	506
75	-495	-401	-333	-280	-235	45	83	111	141	169	196	221	246	271	304	344	391	446	512
80	-529	-430	-358	-301	-254	48	88	116	146	174	201	226	251	276	309	349	396	451	518
85	-563	-459	-382	-323	-273	51	93	121	151	179	206	231	256	281	314	354	401	456	524
90	-598	-488	-407	-344	-292	54	98	126	156	184	211	236	261	286	319	359	406	461	530
95	-632	-517	-431	-366	-311	57	103	131	161	189	216	241	266	291	324	364	411	466	536
100	-666	-545	-456	-387	-330	60	108	136	166	194	221	246	271	296	329	369	416	471	542

## NOTES.

1. This table combines the angle of sight with the angle of tangent elevation, thereby producing the quadrant angle directly.
2. It is used as follows: Range=1,900 yards. Target 55 yards below gun. Quadrant elevation=128 minutes.
3. The top line where V. I.=1 yard is used as follows: Example I—Range=1,900 yards. Target 57 yards below gun. The quadrant angle for range=1,900 and V. I.=55 is 128 minutes. For each extra yard of V. I. the top line shows that 2 minutes must be *subtracted*. Therefore necessary quadrant angle is  $128-(3 \times 2)=124$  minutes. Example II—Range=1,300 yards, V. I.=38 yards, Q. E.= $8-(3 \times 3)=-1$  minute. Example III—Range=1,100 yards, V. I.=47 yards, Q. E.= $-68-(2 \times 3)=-74$  minutes.

## MACHINE GUN NOTES NO. 1.

TABLE 4.—*Wind allowances.*

The following is the usual table for rough guidance:

Yards.	Lateral allowances.					
	Mild.		Fresh.		Strong.	
	<i>Yards.</i>	<i>Minutes.</i>	<i>Yards.</i>	<i>Minutes.</i>	<i>Yards.</i>	<i>Minutes.</i>
500.....	1	5	1½	10	2	15
1,000.....	3	10	6	20	9	20
1,500.....	6	15	12	30	18	45
2,000.....	12	20	24	40	36	60

## NOTES.

- (i) The table is for right-angle winds; halve the allowances for oblique winds.  
 (ii) The minutes of angle should be used in conjunction with a card and string in order to obtain an auxiliary aiming mark on which to order the gunner to lay.  
 (iii) When no clearly defined auxiliary mark is obtainable the lateral angular allowance may be put on by the direction dial, if the angle is reasonably large. If not, the following rough rule may prove of value.  
 (iv) Assume the following factors: Mild, 2; fresh, 3; strong, 4; then multiply the range by the appropriate factor, and the first figure of the answer gives the taps required. Thus fresh wind at 1,500 yards;  $1,500 \times 3 = 4,500$ ; 4 taps are necessary.  
 (v) The deflection due to drift is negligible below 1,000 yards. At 1,500 yards it is about 2 yards. Above 1,500 yards it is unknown but is certainly several yards at extreme ranges.

N. B.—Drift is to the left.

TABLE 5.—*Allowances for atmospheric influences.*

More elevation.	Less elevation.	
Cold (40° F. or less). Strong head wind. Extreme dryness.	Heat (80° F. or more). Strong rear wind. Rain. Over 3,000 feet above sea.	
ALLOWANCES IN YARDS OF RANGE.		
Range.	1 factor.	2 factors.
1,000 yards.....	.....	50
1,500 yards.....	50	100
2,000 yards.....	100	150

TABLE 6.—*Time of flight.*

Total time of flight (in seconds).	Distance covered (in yards).	Total time of flight (in seconds).	Distance covered (in yards).
1.....	600	9.....	2,350
2.....	1,000	10.....	2,450
3.....	1,300	11.....	2,550
4.....	1,550	12.....	2,625
5.....	1,775	13.....	2,700
6.....	1,950	14.....	2,775
7.....	2,100	15.....	2,840
8.....	2,225		

## NOTES.

(i) Due to the effect of light on the human eye, *more* elevation must be given in a very bright light and *less* elevation in a very poor light.

(ii) Factors affecting elevation in opposite directions will naturally cancel out; the result of combined factors only must be used in the allowance table.

(iii) Less elevation is required when firing up or down hill. This may be neglected when the angle of sight to the target does not exceed 10°.



TABLE 7.—*Searching reverse slopes. .303 Vickers gun, Mark VII ammunition.*

[All figures represent yards.]

1	2	3	4	5	6	7	8	9	10	11	12	Gun above or below crest.	1	2	3	4	5	6	7	8	9	10	11	12
1500	1600	1650	1700	1850	1850	1900	1950	2000	2000	2050	2100			1900	1800	1700	1600	1550	1400	1400	1500	1350	1300	1300
1350	1400	1500	1600	1650	1700	1800	1850	1900	1950	2000	2050	0	2050	2000	1950	1900	1850	1700	1700	1800	1650	1600	1500	1350
1400	1450	1550	1600	1700	1750	1800	1850	1900	1950	2000	2050	10	2000	1950	1900	1850	1800	1650	1650	1750	1600	1550	1450	1300
1450	1500	1550	1650	1700	1750	1850	1900	1950	2000	2050	2100	20	2000	1950	1900	1850	1800	1650	1650	1750	1600	1550	1450	1200
1500	1600	1650	1750	1800	1850	1900	1950	2000	2050	2100	2150	30	1950	1900	1850	1800	1750	1650	1650	1750	1600	1550	1400	1250
1550	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	40	1900	1850	1800	1750	1700	1600	1600	1700	1550	1500	1400	1150
1600	1700	1700	1800	1850	1900	1950	2000	2050	2100	2150	2200	50	1850	1800	1750	1700	1650	1550	1550	1650	1500	1450	1300	1150
1650	1750	1750	1850	1900	1950	2000	2050	2100	2150	2200	2250	60	1800	1750	1700	1650	1600	1500	1500	1600	1450	1400	1350	1200
1700	1800	1800	1900	1950	2000	2050	2100	2150	2200	2250	2300	70	1750	1700	1650	1600	1550	1450	1450	1550	1400	1350	1300	1150
1750	1850	1850	1950	2000	2050	2100	2150	2200	2250	2300	2350	80	1700	1650	1600	1550	1500	1400	1400	1500	1350	1300	1250	1100
1800	1900	1900	2000	2050	2100	2150	2200	2250	2300	2350	2400	90	1650	1600	1550	1500	1450	1350	1350	1450	1300	1250	1200	1050
1850	1950	1950	2050	2100	2150	2200	2250	2300	2350	2400	2450	100	1600	1550	1500	1450	1400	1300	1300	1400	1250	1200	1150	1000
1900	2000	2000	2050	2100	2150	2200	2250	2300	2350	2400	2450	110	1550	1500	1450	1400	1350	1250	1250	1350	1200	1150	1100	950
1950	2050	2100	2150	2200	2250	2300	2350	2400	2450	2500	2550	120	1500	1450	1400	1350	1300	1200	1200	1300	1150	1100	1050	900
2000	2050	2100	2150	2200	2250	2300	2350	2400	2450	2500	2550	130	1450	1400	1350	1300	1250	1150	1150	1250	1100	1050	1000	850
2050	2100	2150	2200	2250	2300	2350	2400	2450	2500	2550	2600	140	1400	1350	1300	1250	1200	1100	1100	1200	1050	1000	950	800
2100	2150	2200	2250	2300	2350	2400	2450	2500	2550	2600	2650	150	1350	1300	1250	1200	1150	1050	1050	1150	1000	950	900	750
2150	2200	2250	2300	2350	2400	2450	2500	2550	2600	2650	2700	160	1300	1250	1200	1150	1100	1000	1000	1100	950	900	850	700
2200	2250	2300	2350	2400	2450	2500	2550	2600	2650	2700	2750	170	1250	1200	1150	1100	1050	950	950	1050	900	850	800	650
2250	2300	2350	2400	2450	2500	2550	2600	2650	2700	2750	2800	180	1200	1150	1100	1050	1000	900	900	1000	850	800	750	600
2300	2350	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	190	1150	1100	1050	1000	950	850	850	950	800	750	700	550
2350	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	200	1100	1050	1000	950	900	800	800	900	750	700	650	500

# APPENDIX B.

*Indirect overhead fire sheet.*

[No. 515 M. G. Coy. No. 3 Section. Date, 11.2.19. Map used, 36c N. W. 3. 1/10,000. Officer i/c firing, 2/Lt. D. Hay.]

Gun No.	Target.	Elevation.					Clearance over own troops.					Direction.	Remarks.				
		Range to target (in yards).	Contours in yards.		V. I. (in yards).	Q. E. minutes. Table 3 (A) or 3 (B).	Range for Q. E. (in yards). Table 1, col. 2.	Contour of own troops (in yards). B.	Range to own troops (in yards).	Trajectory height (in yards). Table 2 (A) or 2 (B). C.	Clearance obtained by note (1) below (in yards).	Clearance required (in yards).	Compass bearing or D. D. reading.	Time of firing.	Number of rounds fired.	Checked by—	General.
			Gun. A.	Target.													
1	Dump, U.28.b.5.4.....	2,000	118	93	25	213	1,850	104	400	<sup>1</sup> 23	37	20	80° magnetic....	19.56	500	D. H.	Traversed and searched slightly. Enemy retaliated on front line with 77 mm. shells.
2	Brickworks, U.29.c.0.9.....	1,900	109	140	40	300	2,150	.....	.....	.....	.....	.....	D. D. 62° (left of R. O.).	10.00, 12.24	750	D. H.	Own troops not between gun and target. Artillery F. O. O. reports enemy casualties on both occasions.
3	Crossroads, B.17.d.5.1.....	1,500	111	63	47	28	600	88	700	<sup>2</sup> 1	22	20	D. D. 72°-74° (right of R. O.).	21.15	355	D. H.	Firing line reports noises of stampeding transport. Enemy retaliated on dummy emplacement.
4	Battalion headquarters, B.18.a.8.4.	1,700	132	29	103	-31	.....	114	550	<sup>2</sup> 9	9	20	71° magnetic....	.....	.....	D. H.	Insufficient clearance over own troops. Did not fire.
5-16	Barrage on near edge of Crow Wood.	2,300	<sup>3</sup> 111	138	27	399	2,400	95	1,100	<sup>1</sup> 105	121	40	Parallel lines of fire 101° magnetic.	On call from infantry.	41,500	D. H. L. T. N. R. O. A.	S. O. S. signal at 18.20, 19.30-19.56, and 21.10. No enemy attacks developed.
3	Shafskopf redoubt.....	2,200	119	71	48	258	2,000	99.97	900, 1,500	<sup>4</sup> 53, 53	73, 75	20, 40	Gun laid by day.	19.08	710	D. H.	Traversed slightly. No information as to results.

<sup>1</sup> Positive.

<sup>2</sup> Negative.

<sup>3</sup> Lowest.

<sup>4</sup> Both positive.

## NOTES.

1. Clearance in yards=A-B plus or minus C according as trajectory tables give positive or negative values of C.

2. Immediately before firing Q. E. must be corrected, if necessary, for atmospheric influences, see Table 5.

3. For lateral wind allowance see Table 4.

4. If obstruction exists between gun and target and its highest point can not be seen, ascertain if shots will clear by substituting "Obstruction" for "Own troops" in clearance columns above and find clearance by rule.

Note.—Minimum clearance required is one-half height of cone at range to obstruction.

## NOTES.

1. The top horizontal line is the drop *in yards* in the first 100 yards beyond the crest. The horizontal line directly below it is the distance to measure back from the crest to find gun position.
2. For full explanation of use of table, see section 31.  
*Example*.—The ground drops 7 yards in 100, and assume also that the gun is below the crest. The left-hand side of table must therefore be used. The table shows that for a drop of 7 yards we must go back 1,900 yards from the crest. At this point, say, the gun position is found to be 90 yards below the crest. Final range, therefore, equals 2,000 yards. Place the gun at this point.
3. When the gun is in position, fire should be directed on the crest, elevation and direction being put on by any of the usual methods for indirect fire. In the example given above, the quadrant angle is that for a V.L. of 90 yards and a range of 2,000 yards—i. e., 411 minutes. (See Table 3 (A).)
4. Searching should be employed away from the crest, but it must be remembered that as the cone is beating falling ground the length of the zone will be very much increased; therefore the turns of the wheel should be few in number.
5. If the final position is not suitable the gun should be moved farther away from—not nearer to—the crest, and the elevation increased by the distance moved.
6. If it be desired to engage an area of ground which lies some distance back from the crest, without searching back from the crest itself, the position of the gun must be determined with reference to the crest as detailed above. Then the quadrant elevation necessary to hit the near limit of the ground to be searched must be put on in the usual way for indirect fire.

### KEY TO PLATES.

---






















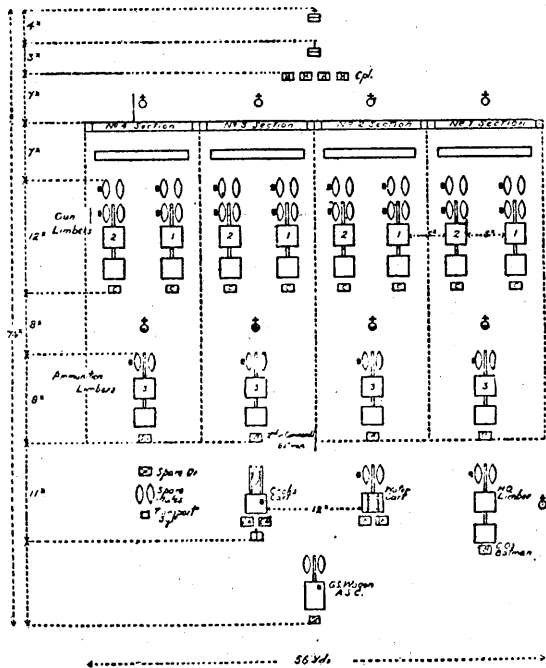
	.....Company commander.
	.....Second in command.
	.....Section officer.
	.....Subsection officer.
	.....Company sergeant major.
	.....Company quartermaster sergeant.
	.....Sergeant.
	.....Corporal.
	.....Range taker.
	.....Scout.
	.....Gun number, lance corporal, or private.
	.....Artificer.
	.....Batman.
	.....Saddler.
	.....Shoeing smith.
	.....Cook
	.....Storeman.
	.....Driver.
	.....Signaler.
	.....Filterer.
	.....Horse or mule.

PLATE I.

MACHINE-GUN COMPANY DRAWN UP IN LINE.



DETAIL OF SECTION

Sub-Section					Sub-Section				
1	2	3	4	5	1	2	3	4	5
6	7	8	9	10	11	12	13	14	15

## PLATE II.

MACHINE-GUN COMPANY IN COLUMN OF ROUTE. ACTION NOT EXPECTED.

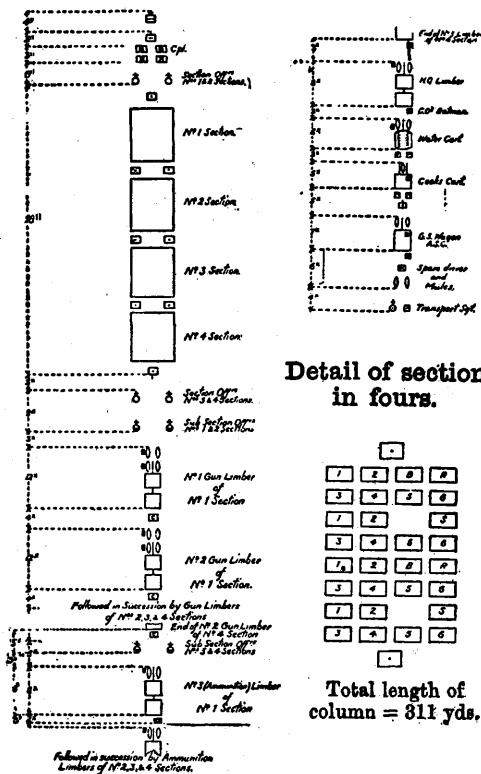
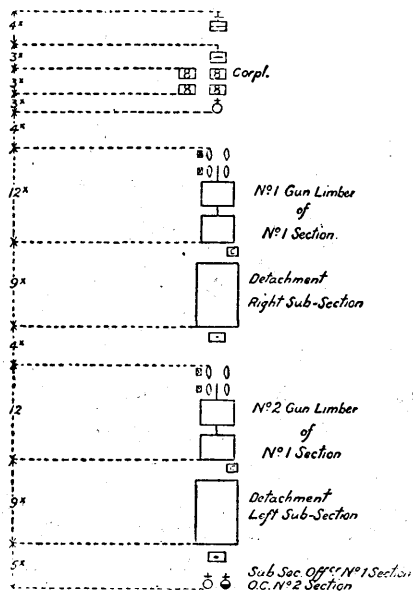


PLATE III.

MACHINE-GUN COMPANY IN COLUMN OF ROUTE. ACTION EXPECTED.



Followed in succession by 2, 3 and 4 sections in above order. The subsection officer of No. 4 section followed by No. 3 (ammunition) limbers and remainder of transport in same order as shown when action is not expected.

Length of column=326 yards.